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Soil Survey

Rhea County Tennessee

By

A. H. HASTY, in Charge, C. A. MOGEN, and C. B. BEADLES
United States Department of Agriculture
and
W. C. SAMS and JAMES TYER
Tennessee Agricultural Experiment Station

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Bureau of Plant Industry, Soils, and Agricultural Engineering
In cooperation with the
TENNESSEE AGRICULTURAL EXPERIMENT STATION
and the
TENNESSEE VALLEY AUTHORITY

HOW TO USE THE SOIL SURVEY REPORT

SOIL SURVEYS PROVIDE a foundation for all land use programs. The reports on each survey and the map that accompanies the report present information both general and specific about the soils, the crops, and the agriculture of the area surveyed. The individual reader may be interested in the whole report or only in some particular part. Ordinarily he will be able to obtain the information he needs without reading the whole. Prepared for both general and detailed use, the report is designed to meet the needs of a wide variety of readers of three general groups: (a) Those interested in the area as a whole; (b) those interested in specific parts of it; and (c) students and teachers of soil science and related agricultural subjects. Attempt has been made to meet the needs of all three groups by making the report comprehensive for purposes of reference.

Readers interested in the area as a whole include those concerned with general land use planning—the placement and development of highways, power lines, docks, urban sites, industries, community cooperatives, resettlement projects, and areas for private or public forests, recreation, and wildlife management. The following sections are intended for such users: (a) General Nature of the County, in which physiography, relief, drainage, climate, water supply, vegetation, history, population, industries, transportation, markets, and cultural developments are discussed; (b) Agriculture, in which a brief history of the agriculture is given and the present agriculture described; (c) Land Classification, Management, and Productivity, in which the productivity of the soils is given, a grouping of soils is presented according to their relative physical suitability for agricultural use, the present use of the soils is decribed, their management requirements are discussed, and suggestions are made for improvement in management.

Readers interested chiefly in specific areas—such as some particular locality, farm, or field—include farmers, agricultural technicians interested in planning operations in communities or on individual farms, and real estate agents, land appraisers, prospective purchasers and tenants, and farm loan agencies. The reader's first step is to locate on the map the tract with which he is concerned. The second is to identify the soils on the tract by locating in the legend on the margin of the map the symbols and colors that represent them. The third step is to locate in the table of contents in the section on Soils the page where each type is described in detail and information given as to its suitability for use and its relations to crops and agriculture. He will also find useful specific information relating to the soils in the section on Land Classification, Management, and Productivity.

Students and teachers of soil science and allied subjects, including crop production, forestry, animal husbandry, economics, rural sociology, geography, and geology, will find their special interest in the section on Morphology and Genesis of Soils. They will also find useful information in the section on Soils, in which is presented the general scheme of classification of the soils of the area and a detailed discussion of each type. For those not already familiar with the classification and mapping of soils, these subjects are discused under Soil Survey Methods and Definitions. Teachers of other subjects will find the sections on General Nature of the County, Agriculture, Productivity Ratings, Land Use and Soil Management, and the first part of the section on Soils of particular value in determining the relations between their special subjects and the soils in the area.

This publication on the soil survey of Rhea County, Tenn., is a cooperative contribution from the—

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

Robert M. Salter, *Chief*

Division of Soil Survey

Charles E. Kellogg, *Head Soil Scientist, in Charge*

TENNESSEE AGRICULTURAL EXPERIMENT STATION

C. A. Mooers, *Director*

and the

TENNESSEE VALLEY AUTHORITY

Series 1940, No. 3 Issued March 1948

SOIL SURVEY OF RHEA COUNTY, TENNESSEE[1]

By A. H. HASTY, in Charge, C. A. MOGEN, and C. B. BEADLES, Division of Soil Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, United States Department of Agriculture, and W. C. SAMS and JAMES TYER, Tennessee Agricultural Experiment Station

Area inspected by J. W. MOON, Principal Soil Scientist, Division of Soil Survey

United States Department of Agriculture in cooperation with the Tennessee Agricultural Experiment Station and the Tennessee Valley Authority

CONTENTS

[1] The report was revised by M. J. Edwards and M. G. Cline, Division of Soil Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

RHEA COUNTY was organized from a part of Roane County in 1809. The settlers, largely of Scotch-Irish descent, came from southwestern Virginia, upper Tennessee, and North Carolina. About 40 percent of the land is cleared, mostly for crops and pastures. Corn, wheat, and hay are the chief field crops, strawberries are an important cash crop, and certain truck crops are grown for the Chattanooga market. Lumbering and coal mining are of some importance, although the market for coal is limited to local requirements. A system of dams have been built on the Tennessee River, two reservoirs of which—the Chickamauga and Watts Bar—are in Rhea County. To provide a basis for the best agricultural uses of the land a cooperative soil survey was begun in 1940 by the United States Department of Agriculture, the Tennessee Agricultural Experiment Station, and the Tennessee Valley Authority. The essential features may be summarized as follows.

SUMMARY

Rhea County, in southeastern Tennessee about midway between Chattanooga and Knoxville, lies partly in the Valley and Ridge prov-

ince of eastern Tennessee and partly on the Appalachian Plateaus province, or Cumberland Plateau. The part in the Valley and Ridge province is characterized by parallel ridges and valleys that cross the county in a northeast-southwest direction and is underlain by folded and faulted rocks of sedimentary origin and generally with a pronounced dip. The northwestern third of the county is on the Appalachian Plateaus physiographic province and is characterized by high-lying, relatively smooth areas interspersed with deep, narrow, V-shaped valleys of dendritic pattern. The rocks that underlie this part of the county are mainly sandstone and are generally level-bedded. The general elevation of the Appalachian Plateaus is between 1,400 and 2,000 feet; and of the Valley and Ridge province between 600 and 1,000 feet.

Rhea County was originally covered by forests predominantly of hardwood or mixed hardwood and pine. Large areas on the Appalachian Plateaus and on the cherty ridges of the Valley and Ridge province are now in cut-over forest, but the greater part of the county has been cleared and used for crops or for pasture. The idle areas are covered by a brushy growth of shrubs and weeds.

The kinds of agriculture vary considerably in the different parts of the county. Corn, wheat, and hay are the principal commercial crops, and strawberries and some truck crops are grown as cash crops. Corn and hay occupy by far the greater part of the tilled areas. Livestock consists mainly of dairy animals, sheep, hogs, and beef cattle, the last being of minor importance. Dairying, both as a specialty and as an adjunct to general farming, is carried on extensively in certain parts of the Valley and Ridge province. Chickens, chiefly farm flocks, are a fairly important source of cash income. Farms in the more productive sections of the county have more modern conveniences, the county has good railway and highway facilities, and the Tennessee River is being developed for navigation. Manufacturing industries are of minor importance to farming.

On the basis of physical characteristics, the soils of the county are classified in 114 soil types and phases and miscellaneous land types of 41 soil series. The soil map prepared shows the areal extent and geographic distribution of each of the 114 units, and each of these is described in the report, which contains also a discussion of the present agriculture and of the limitations or suitability of the soils for agriculture, with suggestions for management for the uses to which they are well suited.

Differences among soils have been important factors in bringing about local variations in the present agriculture. The soils differ greatly in their suitability for agricultural use and in their requirements for good management for various uses and are not commonly managed in a way suitable for the fullest realization of their capabilities. There is a fairly consistent relation between the suitability of the soils for agriculture and the general well-being of the people on the land. The soils also differ widely in color, texture, structure, consistence, fertility, and relief and in conditions of stoniness and erosion. The colors of the surface soils range from dark brown to yellow, gray, or almost white. Content of organic matter and fertility generally decrease as the color becomes lighter. Colors of the subsoils range from brown to red, yellow or light gray. The soils that have red or

brown subsoils are generally more productive than those that have gray subsoils. Textures range from almost pure sand to clay. Most of the soils are well drained.

Soils that are poorly suited physically to the production of tilled crops occupy about 99,000 acres, or 46 percent of the county. Steep slopes, extensive stoniness, accelerated erosion, poor drainage, shallowness, and unfavorable consistence are the factors that most commonly limit suitability for tillage.

The soils on about 115,000 acres, or 54 percent of the county, are at least fairly well suited physically to tilled crops. The relief of almost half the area is nearly level or undulating. About three-fourths is almost stone-free. About one-third has lost little if any of the soil by accelerated erosion; the rest is sufficiently eroded for subsoil material to be turned up in tillage.

On the basis of the average of the Valley and Ridge province of east Tennessee as a standard, it is estimated that about 20 percent of the 115,000 acres at least fairly well suited to tilled crops is relatively high in productivity, that about 30 percent approximates the average of productivity, and that about 50 percent is relatively low. Almost all the soils are deficient in lime. Good management is required for the maintenance of nitrogen and organic matter; phosphorus is a limiting element on most of the soils; and potash is limiting on a much smaller part. As a rule these soils are less fertile than most soils of the western prairies, but generally more fertile than comparable soils farther south and southeast, where the temperature is higher and leaching has been more severe, though fertility differs greatly throughout the county.

Good tilth of surface soils is easily obtained and maintained except on some of the heavier textured soils, which are subject to puddling and surface packing when tilled under adverse moisture conditions. With relatively few exceptions such heavy-textured soils were originally subsoils and have been exposed by the loss of the original surface soil.

Yields that may be expected under each of three defined levels of management are given for each soil and for each of the more commonly grown crops. Marked increases of crop yields above those commonly obtained can be expected on most soils if management is improved. Yields commonly obtained are higher than those that are obtained under a poor level of management.

For the purpose of physical land classification, the soils are placed in five groups on the basis of the physical suitability, which is determined by soil productivity, workability, and conservability. These five groups, in decreasing order of desirability for agriculture, are termed First-, Second-, Third-, Fourth-, and Fifth-class soils.

First-class soils, aggregating 4.3 square miles, are physically very good for agriculture—they are good to excellent for crops that require tillage and good to excellent for permanent pasture. They are highly productive of the crops commonly grown, easily conserved, and easily worked.

Second-class soils, 43.4 square miles, are physically good soils for agriculture—they are fair to good for crops that require tillage and fair to excellent for permanent pasture. Some one condition or some combination of the conditions of productivity, workability, or con-

servability is poorer for each of these than for any of the first-class soils.

Third-class soils, 91.3 square miles, are physically fair soils for agriculture—they are poor to fair for crops that require tillage and fair to very good for permanent pasture. In one or more of the qualities of workability, conservability, or productivity, each soil is sufficiently poor for its physical suitability for tilled crops to be definitely limited.

Fourth-class soils, 56.8 square miles, are physically poor for agriculture—they are poorly suited to crops that require tillage but at least fairly well suited to permanent pasture. Each one is so difficult to work or so difficult to conserve, or both, that management practices necessary to success with crops are commonly not feasible on many farms under present conditions.

Fifth-class soils, 139.2 square miles, are very poorly suited to agriculture—they are very poor for crops that require tillage and poor to very poor for permanent pasture. Each is so low in content of plant nutrients or so poor in moisture relations, or both, that common pasture plants produce very little feed. They are apparently best suited physically to forest or similar uses under present conditions.

In discussing land uses and soil management, the soils are grouped according to similarities of management requirements. Each group is discussed with respect to choice and rotation of crops; use of lime, commercial fertilizers, and manure; tillage practices; engineering methods for the control of water on the land; and practices of good pasture management. A table shows the ease with which plant nutrients, soil material, and good tilth can be conserved.

Practices that control water on the land also aid in increasing crop production. It would be practicable to improve soil-management practices on a large part of the farms. Rotations that include leguminous sod-forming crops and mineral amendments, particularly lime and phosphorus, are among the more important requirements for most soils.

The subject of morphology and genesis of soils is treated in relation to the factors of soil formation and the conditions of these factors in the county. The soils are grouped into higher categories; each soil series is described; and the factors of soil formation that have influenced its morphology are discussed. The great soil groups represented are the Red and the Yellow Podzolic soils, Planosols, Half Bog and alluvial soils, and Lithosols.

The objectives of the soil survey of Rhea County, Tenn., are (1) to supply a common frame of reference for interchange of information about soils, (2) to provide a map that shows the location and extent of different kinds of soils, and (3) to assemble available information about these soils.

GENERAL NATURE OF THE COUNTY

The northwestern third of Rhea County lies within the Appalachian, or Cumberland Plateau, physiographic province (*2*)[2] and is

[2] Italic numbers in parentheses refer to Literature Cited, p. 203.

composed of steep, stony slopes and relatively high-lying smooth ridge tops. The soils are sandy and shallow to bedrock, and much of this part of the county is still under hardwood and mixed hardwood and pine forest. The southeastern two-thirds is within the Appalachian Valley, or Valley and Ridge, physiographic province and is made up of lower alternate ridges and valleys. The soils here are underlain chiefly by folded limestones and shales, and a considerably greater acreage is cleared and cropped.

About 40 percent of the land in the county is cleared, mostly for crops and pastures, although a large acreage of land is idle in certain parts of the Valley and Ridge province. Corn, wheat, and hay are the chief field crops, strawberries are an important cash crop, and certain truck crops are grown for the Chattanooga market. Mixed types of agriculture and the closely related activities involved in marketing and retail services are the chief occupations of the people. Lumbering and coal mining are of some importance, although the market for coal is limited to local requirements. There are no large cities.

LOCATION AND EXTENT

Rhea County occupies 335 square miles (214,400 acres) in southeastern Tennessee (fig. 1). The Tennessee River marks the south-

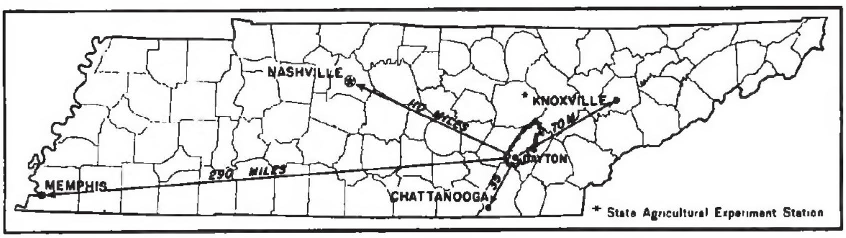

FIGURE 1.—Location of Rhea County in Tennessee.

eastern boundary, and the northwestern boundary for the most part is on the Cumberland Plateau and parallels the Cumberland escarpment. Dayton, the county seat, is in the southern part, 38 miles northeast of Chattanooga and 83 miles southwest of Knoxville.

PHYSIOGRAPHY, RELIEF, AND DRAINAGE

The rocks of the Valley and Ridge province are folded and consist chiefly of shales and limestones, including dolomitic limestones of the Cambrian and Ordovician systems; whereas those of the Cumberland Plateau are nearly level-bedded and are chiefly sandstones of the Pennsylvanian series of the Carboniferous system.[3]

The Valley and Ridge province is comprised chiefly of parallel hilly to rugged ridges with intervening parallel valleys. The present topography is chiefly the result of differential erosion of folded rock beds that differ greatly one from another in resistance to weathering.

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[3] Areal geology from map of Watts Bar Dam Site by Water Control Planning Department, Tennessee Valley Authority.

The ridges run in a northeast-southwest direction, corresponding to the strike of the exposed rock. The drainage system accordingly is of the adjusted stream pattern. Surface drainage is well developed, and poorly drained areas are confined mainly to first bottoms. There are no natural lakes, but about 4,400 acres is occupied by Chickamauga Reservoir and about 8,700 by Watts Bar Reservoir. The elevation ranges from about 670 feet where the Tennessee River leaves Rhea County to about 1,100 feet along the crests of some of the cherty and shale ridges. The difference in elevation between the valleys and ridges ranges from 200 to about 400 feet.

The chief parent rocks of the soils of this part of the county are limestones, including dolomitic limestones; shales; and sandstones. These rocks, especially the limestones and shales, vary among themselves considerably and give rise to widely different soils. Associated with some of the valleys are irregular disconnected high-lying areas of alluvial terraces or benches. These terraces are comprised for the most part of alluvium, the material of which was derived chiefly from limestones, shales, and sandstones of the Valley and Ridge province and to a less extent from the sandstones of the Cumberland Plateau and from metamorphosed rocks of the Blue Ridge province.

The Appalachian, or Cumberland Plateau, province is chiefly a high, broad ridge thoroughly dissected by local dendritic drainage systems. The southeastern face of this area presents a precipitous, rocky, well-discerned escarpment that rises about 800 feet above the valley floors of the Valley and Ridge province to the southeast. Deep rocky gorges extending northwestward from the escarpment well into the Cumberland Plateau produce a rugged surface over a great part of the area. Precipitous slopes to valleys 400 to 600 feet deep are common. Most of the streams have a strong gradient and follow a general southeasterly course toward the Tennessee River. The ridge land varies from narrow, tortuous, sharply rounded ridges to relatively broad smooth areas as much as half a mile wide. The chief parent rocks of this part are standstones and shales. Surface drainage is well developed, and poorly drained areas are confined to narrow drainageways and to small areas at the head of some of the draws.

The general relief of the county is indicated by the following elevations above sea level:[4] Chickamauga Reservoir, 683 feet; Watts Bar Reservoir, 741 feet; Dayton, 700 feet; Spring City, 765 feet; crest of cherty limestone ridge south of Spring City, 920 feet; crest of shale ridge east of Spring City, 1,040 feet; crest of Cumberland escarpment north of Spring City, 1,440 feet; and smooth ridge top of Cumberland Plateau at Morgan Springs, near the Bledsoe County line, 1,935 feet.

CLIMATE

The climate of Rhea County is temperate and continental. The winters are moderate with short cold periods and the summers are warm, but maximum temperatures of 100° F. are rare, especially on the Cumberland Plateau. The spread between the mean summer and winter temperatures is 33.4° on the Cumberland Plateau and 35.6°

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[4] Elevation data from U. S. Geological Survey topographic maps and from Tennessee Valley Authority maps and charts.

in the Valley and Ridge province. The highest recorded temperature is 108°, and the lowest is −20°.

The average frost-free season in the valley is about 192 days (April 13 to October 22) and on the plateau about 179 days (April 18 to October 14). The growing season is sufficient to mature practically all field crops common to this part of the United States. Late spring frosts occasionally damage the fruit crop, but early fall frosts are seldom if ever harmful except to certain late-planted truck crops. The ground freezes infrequently to a depth of a few inches but seldom remains frozen for more than a few days at a time. Periods of recurrent freezing and thawing, however, are very characteristic of late fall, winter, and early spring, and material damage is done to fall-sown crops in some years. Frost action also contributes greatly to the erosion hazard, especially by loosening the soil from the root mass. The growth of vegetation almost ceases in winter, but with proper selection of crops a cover can be maintained through the winter, to serve as a deterrent to erosion and to prolong the grazing period beyond the frost-free season. Although field work is greatly reduced in winter, many outside farm activities can be carried on during most of this season.

The average precipitation on the Cumberland Plateau is 54.19 inches and in the Valley and Ridge part a fraction of an inch more. Snowfall averages 8.7 inches in the valley and 12.1 on the plateau. Total precipitation for the driest year in the valley was 36.06 inches, and for the wettest, 70.66; and on the plateau, 41.34 and 70.05, respectively.

Moisture conditions are favorable for crop growth through spring, early summer, and midsummer, but relatively dry conditions prevail through late summer and fall. Rainfall during July and August is as much as in spring, but the reduction in the reserve from these earlier months by transpiration and evaporation and the high rate of evaporation during these two summer months result in a relatively dry condition late in summer as well as in fall. This relatively dry late summer and fall season is not favorable either for fall tillage operations or for optimum growth of pasture or of winter wheat, crimson clover, vetch, and other fall-sown crops. It is favorable, however, for harvesting and is responsible for relatively low losses of crops through unfavorable weather conditions after maturity.

Air movement (wind) is of low average velocity, and severe weather conditions, such as hailstorms and tornadoes, are infrequent. Rains, however, are often sufficiently heavy to cause considerable runoff, and where the soil is not properly protected, material soil losses result. The erosion hazard is greatest late in winter and early in spring, at which seasons precipitation is heavy and the loosening effect of alternate freezing and thawing of the surface soil is greatest.

Table 1, compiled from records of the United States Weather Bureau stations at Decatur, Meigs County (in the Valley and Ridge province just east of Rhea County), and at Crossville, Cumberland County (15 miles northwest of Rhea County), gives the normal monthly, seasonal, and annual temperature and precipitation at these places, which may be taken as fairly representative of conditions in Rhea County in the Valley and Ridge province and on the Cumberland Plateau, respectively.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at stations near Rhea County, Tenn.*[1]

Decatur, Meigs County, elevation, 850 feet

Month	Temperature: Mean	Temperature: Absolute maximum	Temperature: Absolute minimum	Precipitation: Mean	Precipitation: Total amount for the driest year	Precipitation: Total amount for the wettest year	Precipitation: Average snowfall
	°F	°F	°F	Inches	Inches	Inches	Inches
December	40 8	76	−4	6 05	1 99	2 68	2 0
January	40 3	76	−9	4 76	4 37	3 83	2 4
February	41 9	78	−20	4 85	2 49	15 11	2 4
Winter	41 0	78	−20	15 66	8 85	21 62	6 8
March	50 5	91	2	5 87	1 73	12 12	1 3
April	58 4	94	20	4 84	4 00	6 58	(2)
May	67 3	99	30	4 20	2 27	4 43	0
Spring	58 7	99	2	14 91	8 00	23 13	1 3
June	74 9	103	40	4 67	1 48	6 58	0
July	77 9	108	48	5 01	1 14	5 50	0
August	77 1	107	49	4 36	3 31	5 43	0
Summer	76 6	108	40	14 04	5 93	17 51	0
September	72 0	106	34	3 20	42	18	0
October	60 1	96	19	3 31	7 28	4 10	(2)
November	48 4	82	−7	3 72	5 58	4.12	6
Fall	60 2	106	−7	10 23	13 28	8 40	6
Year	59 1	[3] 108	[4] −20	54 84	[5] 36 06	[6] 70 66	8 7

Crossville, Cumberland County, elevation, 1,810 feet

Month	Temperature: Mean	Temperature: Absolute maximum	Temperature: Absolute minimum	Precipitation: Mean	Precipitation: Total amount for the driest year	Precipitation: Total amount for the wettest year	Precipitation: Average snowfall
December	38 9	71	−13	5 24	3 23	7 84	2.7
January	37 7	70	−14	4 99	2 15	5 32	3.0
February	39 5	76	−8	4 65	6 84	4 10	3 2
Winter	38 7	76	−14	14 88	12 22	17 26	8 9
March	45 6	81	1	5 92	5 73	9 69	1 8
April	55 3	91	14	4 79	2 20	8 16	1
May	63 3	93	32	4 10	4 01	5 51	0
Spring	54 7	93	1	14 81	11 94	23 36	1 9
June	70 5	100	38	4 52	1 52	7 06	0
July	73 6	102	40	5 62	2 92	7 10	0
August	72 1	102	41	4 55	2 95	9 28	0
Summer	72 1	102	38	14 69	7 39	23 44	0
September	68 2	103	27	3 30	3 95	1 72	0
October	56 9	90	18	3 17	2 80	2 85	.1
November	45 9	78	0	3 34	3 04	1 42	1.2
Fall	57 0	103	0	9 81	9 79	5 99	1.3
Year	55 6	[7] 103	[8] −14	54 19	[9] 41 34	[10] 70 05	12.1

[1] Data from U S Weather Bureau.
[2] Trace
[3] In July 1930
[4] In February 1905
[5] In 1925.
[6] In 1903
[7] In September 1925.
[8] In January 1918.
[9] In 1930.
[10] In 1922.

WATER SUPPLY

The supply of water for livestock and household use varies with the section and the season. In winter, spring, and early summer a sufficient supply is usually available in practically all parts of the county, but late in summer and in fall many streams and, in some areas,

many wells dry up or their flow is materially reduced. Practically all surface streams on the ridges of the Cumberland Plateau cease flowing late in summer and in fall, and shallow wells are not reliable, but those more than 100 feet deep generally give a fair supply through the drier periods. The cherty ridge lands of the Clarksville-Fullerton soil association areas (see fig. 4, p. 36) also have a variable water supply. The larger streams generally flow continuously, but permanent springs are not numerous and wells on the ridges commonly cease to yield during the drier months. Cisterns and artificial ponds are used by some to meet household and livestock requirements.

From a few springs in the draws and valleys of the shale ridges (Muskingum-Apison soil associations) the water supply is fairly permanent. Permanent springs, streams, and wells are common to the limestone valleys (Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations), and an abundant supply of water is available from the streams and shallow wells on the first bottoms (Sequatchie and Huntington-Wolftever-Sequatchie soil associations) along the Tennessee and Piney Rivers and White and Richland Creeks.

VEGETATION

The virgin forest of Rhea County was predominantly hardwood and mixed hardwood and pine. The smoother well-drained areas were occupied chiefly by hickory, chestnut, oak (Spanish, red, white, and post oaks), and dogwood. Mixed shortleaf pine and hardwoods predominated along the base of the Cumberland escarpment and on some of the shale ridges in the eastern part of the county. Hemlock occupied some of the gorges of streams of the Cumberland Plateau, where there was less danger of fire, the air was cool, and seepage waters were common through most of the growing season. White pine was common in parts of the shallower gorges. Mountain-laurel, holly, and rhododendron have always been abundant on the steeper slopes of the Cumberland Plateau region, especially where sandstone outcroppings occur. Wild huckleberry has always been common under the stunted hardwood growth on the shallow soils overlying the sandstone of the Cumberland Plateau.

A great part of the timber has been cleared from most of the well-drained valley lands, and considerable quantities have been cut from the plateau. According to the Forestry Relations Department of the Tennessee Valley Authority,[5] there are about 120,000 acres of forest land in Rhea County. More than 50 percent of this is in hardwood; about 40 percent is in mixed hardwood and pine; and about 4 percent is in hemlock and white pine. A great part of the forest acreage is now within the Cumberland Plateau section. Where the forest cover has been completely or heavily cut-over, the forest type at present is similar to that of the virgin cover, with the exception of the chestnut trees, the entire stand of which has been killed by blight. Much of the dead chestnut timber still stands, however, especially on the Cumberland Plateau.

Throughout practically all the county, Virginia and shortleaf pine establish stands on abandoned or idle land if seed trees are in the

[5] TENNESSEE VALLEY AUTHORITY, DEPARTMENT OF FORESTRY RELATIONS. FORESTRY DATA FOR THE TENNESSEE VALLEY. PART 1. T. V. A. Forestry Bul. 3, 155 pp., illus. 1941. [Processed.]

vicinity, and these pines seem to be increasing rapidly in some parts. In the absence of seed pines, abandoned fields generally grow a cover of sassafras and persimmon, to be displaced later by the hardwoods of the original cover. Under planned conservation programs, farmers are planting a considerable quantity of loblolly and shortleaf pines and some black locust and black walnut.

WILDLIFE

Tennessee and Piney Rivers and White, Yellow, Clear, and Richland Creeks furnish limited facilities for fishing. The Tennessee River is ample for boating, although all-weather landings at present are limited to the ferry landings. Lakes impounded by the Chickamauga and Watts Bar Dams should add to the fishing and boating facilities. A fish-rearing pond is on Yellow Creek near its confluence with the Chickamauga Reservoir. There is some small game throughout most of the county, especially on the Cumberland Plateau.

ORGANIZATION AND POPULATION

Rhea County (*3*) was organized from a part of Roane County in 1809, and at that time included part of Hamilton County. When the tract including Meigs County was acquired from the Indians in 1819, that part north of the Hiwassee River was added to Rhea County, but this area was severed when Meigs County was established in 1835. The county seat of Rhea County was first near Evensville, but 2 years later was moved to Washington, an important agricultural section nearer river transportation. The county seat was finally moved to Dayton in 1890, which was then a growing city on a newly constructed railroad. The Southern Railway, from Chattanooga to Cincinnati, which traverses the entire length of the county, was completed about 1880. At about this time iron and coal mines, operated largely by English interests, were established, but they ceased operation after about 40 years.

The county was settled by people, largely of Scotch-Irish descent, from southwestern Virginia, upper Tennessee, and North Carolina. During the three decades from 1880 to 1910, the population increased from 7,073 to 15,410, but the 1920 census showed a decrease to 13,812. Since then the trend has been chiefly upward, as indicated by the 1940 census figure of 16,353. The entire population is classed as rural—7,506 as rural farm and 8,847 as rural nonfarm. Dayton, the largest municipality, had a population of 1,870 in 1940, Spring City 1,569, and Graysville 846. The average density of the rural farm population is 22.4 to the square mile; the average for the county is 48.8. A large part of the population is in the Valley and Ridge province, or in the eastern two-thirds of the county. Only a few hundred people live on the Cumberland Plateau. The Negro population, 841 in 1940, evidently has been rather stable, inasmuch as the slave population in 1860 was reported as 615. There are 22 Indians in the county.

INDUSTRIES

Industries other than agriculture have some importance in Rhea County. In Dayton there are three hosiery mills, one underwear factory, two feed mills, and one coal-mining company; two lumber

mills, one rayon mill, and a small canning plant are at Spring City (see fig. 20); and about 25 men are employed in mining clay for tile in the vicinity of Graysville. Several small coal mines along the face of Walden Ridge employ 20 to 30 men, some of whom are part-time farmers.

About 160 men are employed at various small sawmills and planing mills throughout the county, and in winter many farmers on the Cumberland Plateau cut timber for cross ties and telephone poles. According to the Federal census, there were 121 coal miners, 483 workers in textile mills, and 96 engaged in the manufacture of apparel and other fabricated textile products. Employees other than salaried officials earned $391,670 in industry in 1939. The value of products manufactured or mined was $1,667,187.

TRANSPORTATION AND MARKETS

Dayton, which is within easy reach of more than half the county and of small areas outside, is the principal shipping point for farm products, especially strawberries. Railway and highway facilities give easy access to Chattanooga and to northern markets. A small ice cream plant and a canning plant at Dayton, together with the local consumption, afford a limited market for milk and truck crops. Spring City is the second most important shipping point for strawberries and milk and, like Dayton, affords a limited market for farm products. It has a small vegetable canning plant and two planing mills, and is a shipping point for a considerable quantity of lumber, cross ties, and telephone poles. Graysville, in the southern part of the county, is a shipping point for the clays obtained in the immediate vicinity.

The county as a whole has good rail and highway facilities. The main line of the Southern Railway from Cincinnati to Chattanooga and United States Highway No. 27 traverse the full length of the county from northeast to southwest. Regular truck and bus service is maintained over U. S. 27. State highways cross the lower part of the county from west to east by way of Morgan Springs, Dayton, and Washington, and the northern part from north to southeast by way of Grandview, Spring City, and Pinhook Ferry. There are fair county roads throughout most of the Valley and Ridge section, where chert and lime rock are available for surfacing. Roads on the Cumberland Plateau, however, especially in the more remote parts, are not well maintained, and some of them are not passable during wet weather.

No regular boat services are available now, but formerly most of the corn and livestock were shipped on the Tennessee River. River transportation facilities have been improved by the 9-foot channel now maintained on the Tennessee River by a system of dams, including the Chickamauga and Watts Bar Dams.

Trucks collect milk daily from the dairying sections for the Chattanooga creameries, and most farm products, including corn, cattle, hay, and truck crops, are hauled by truck from the farm to the market or to shipping points. Rolling stores, which accept poultry, dairy, and other farm products in trade, reach nearly all parts of the county at least once a week.

CULTURAL DEVELOPMENT AND IMPROVEMENTS

Grade schools are conveniently located for all but a few of the more isolated parts of the county. Most of these schools have only one or two teachers and operate for 8 months. High schools at Dayton and Spring City operate 9 months, and busses afford transportation to them from nearly all sections. At Dayton also is the William Jennings Bryan University, a small college offering degrees in a limited number of subjects. Most communities have churches.

About 750 telephones are in the county, mostly in Dayton, Spring City, and Graysville, but 93 were reported on farms on April 1, 1940. On 221 farms dwellings are lighted by electricity. Only a few farm families are as much as a mile from one of the rural mail routes that serve all parts of the county.

AGRICULTURE

Authentic information regarding the early agriculture of the white man in Rhea County is meager. The first of the white settlements were made about 1800 in the northern end of the county at or near the present site of Roddy. The principal crops of the early days were corn and wheat, and cattle, hogs, and sheep were raised. Some flax, tobacco, and maple sirup and sugar was produced for home consumption, and most of the clothing, shoes, and furniture was made at home. The principal foods of the day included salt pork potatoes, beans, turnips, corn bread, coffee, and milk. Agriculture then, as now, was the main industry, but from 1880 to 1920 coal and iron mining and smelting were of importance.

Development undoubtedly was hindered by the slowness and difficulties of overland transportation. The Tennessee River was the chief outlet for products and for travel to New Orleans, and wagon roads were the only outlets to Richmond, Baltimore, Philadelphia, and other large cities. The small quantity of supplies required from the outside came largely from these three cities, and as a consequence very few heavy commodities were brought in. The chief items of produce sold—corn, oats, pork, cattle, and certain other farm and forest products—were shipped by flatboat to New Orleans. Some lighter products, as furs, hides, wax, and tallow, were sent overland to the northeastern markets.

Transportation facilities were greatly augmented when the railroad, completed in 1880, made better markets available for farm products. Wheat became an important cash crop early, and its peaks of production were about 1880, 1900, and during World War I. Since about 1920, the acreage has dropped, until in 1939 it was at its lowest level since 1880, and its production has fluctuated widely. The production of corn has been somewhat more stable. Although raised both as subsistence and cash crops, wheat and corn were the only crops commonly sold until about 1900. By this time, strawberries had become an important cash crop, and the production increased until about 1930, but decreased from 1930 to 1940. Other fruit and truck crops that have come to be of some importance since about 1900 are apples, peaches, potatoes, green beans, and cabbage, and, in small acreages, cotton and tobacco.

CROPS

The principal crops at the present time are corn, wheat, hay, and strawberries. Some of the less important crops are oats, rye, soybeans, and peas. Strawberries (fig. 2, *A*) and tobacco are the principal cash crops, but wheat and corn are grown both for the market and as subsistence crops. Small acreages of tomatoes, potatoes, sweetpotatoes, green beans, cabbage, and certain other vegetables are grown as both

FIGURE 2.—*A*, Strawberry field 3½ miles south of Dayton. Strawberries are an important cash crop in Rhea County, and are grown mostly on recently cleared Clarksville and Fullerton soils. *B*, Commercial peach orchard on Fullerton and Clarksville soils 4 miles south of Dayton. Properly managed orchards on Fullerton soils produce good quality fruit, with yields of 200 to 300 bushels an acre under favorable conditions.

cash and subsistence crops. Peaches (fig. 2, *B*), apples, pears, cherries, grapes, and other fruits are grown as cash crops on a very few farms, but small quantities are commonly produced on a great many for home use. The chief hay crops at present are lespedeza, soybeans, cowpeas, and clover and grass. Some alfalfa is being grown.

The acreage and production of hay has increased quite consistently since 1880. It appears that grasses, including small grains, were the chief hay crops during the earlier period of agricultural development. Lespedeza became a crop of considerable importance about 1925, and during recent years the acreage of alfalfa has much increased. The principal changes in acreage and production of crops are: (1) A marked decrease in the production of wheat; (2) a marked increase in the production of hay crops; (3) a marked relative increase in the acreage of legume hay crops; and (4) a decrease in the acreage of strawberries and certain other truck crops.

The acreage of the principal crops grown in Rhea County, as compiled from census reports, are given in table 2.

TABLE 2.—*Acreage of the principal crops and number of bearing fruit trees and grapevines in Rhea County, Tenn., in stated years*[1]

Crop	1879	1889	1899	1909	1919	1929	1939
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Corn for grain	16,453	17,192	21,241	16,324	18,619	17,347	15,297
Oats							
Threshed	3,848	5,542	1,670	1,919	955	180	274
Cut and fed unthreshed						328	393
Wheat	4,764	2,761	6,648	1,929	3,374	1,439	884
Rye	209	64	28	89	253	283	432
Field beans and peas	(2)	(2)	1,126	602	169	[3] 2,735	324
Hay and forage	[4] 1,820	[4] 5,325	4,807	11,156	15,674	9,913	15,293
Timothy and clover, alone or mixed				2,557	944	1,317	636
Clover alone			566		201	324	[5] 8,035
Alfalfa			11		52	31	237
Annual legumes for hay					4,275	2,671	2,951
Small grain hay			1,437	1,114	1,152	235	452
Other tame hay			2,411	7,156	6,748	4,358	1,876
Wild hay			198	133	295	445	681
Silage and forage			[6] 184	[6] 196	1,712	[7] 203	[7] 173
Sorghums cut for silage, hay, or fodder					295	329	252
Potatoes	(2)	346	309	485	297	458	343
Sweetpotatoes	143	169	169	188	201	679	318
Market vegetables					666	1,374	689
Sweet sorghums for sirup		304	157	135	247	111	96
Tobacco	17	17	30	2	3	3	31
Cotton	9		3		51	50	19
Strawberries			1,007	2,399	1,713	2,751	1,210
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
Apples ... trees		61,837	102,655	59,254	40,867	48,945	30,627
Peaches ... do		64,692	82,123	67,458	14,521	46,241	10,398
Pears ... do		372	5,330	9,053	10,125	12,245	8,268
Plums and prunes ... do		2,331	1,847	2,103	949	1,106	643
Cherries ... do		176	1,486	1,800	3,387	2,186	3,177
Grapes ... vines			17,583	2,493	2,485	18,694	30,268

[1] Trees and grapevines, as of census years 1890–1940
[2] Acreage not reported
[3] Annual legumes for all purposes, except plowed under, partly duplicated in annual legumes for hay.
[4] Hay only.
[5] Lespedeza, 7,947 acres, sweetclover, 88 acres
[6] Forage only.
[7] Corn.

Corn is the most important crop in the county from the standpoint of total value and is grown on a great variety of soils. The average yield during the last 55 years is about 20 bushels to the acre, according to the United States census. The county produces somewhat more corn than it uses, and the greater part of this surplus is

trucked to the Chattanooga market or sold to feed mills in Dayton, where it is ground and shipped in mixed feeds. The greater part of the surplus corn has been produced on the first bottoms along the Tennessee River and the larger creeks.

Wheat ceased to be an important cash crop in recent years and is now produced mainly for household use. All of it is winter wheat and the average yield is about 8 bushels an acre. The greater part of the small-grain acreage is on the soils of the high terraces and the more level red soils of the uplands. Some rye is grown on the less fertile soils of the cherty ridges and on the Cumberland Plateau.

Although corn is the most important crop from the standpoint of value, hay crops occupy approximately as much acreage and, whereas the acreage in corn has diminished somewhat during recent years, that in hay has increased. The acreage of hay and forage crops in 1939, according to the census, was 15,293, which is an increase of about 54 percent over the total acreage of these crops in 1929. Lespedeza is the most important hay crop. Next in importance are the summer legumes, as cowpeas and soybeans, with redtop and other grasses making up a considerable part of the remaining acreage. The acreage of red clover and alfalfa is small but in general is increasing. Quantities of serecia lespedeza and kudzu are grown. The recent increase in the use of lime and phosphate has accomplished the growing of more legumes, particularly alfalfa and red clover. A small part of the hay crop is sold to both local and outside markets, but most of it is fed to livestock in the county.

Strawberries are by far the most important cash crop, although the production has dropped from the peak of 1929. The average yield for the last 35 years is about 1,172 quarts an acre. Most of the strawberries are shipped by railroad and trucks to northern markets from late in April to early in June. A large part of the strawberry acreage has been on the soils of the cherty ridges. The common practice has been to clear a few acres of new land for strawberries, maintain production for about 3 years, and then abandon it. There is now very little land available for this practice, and consequently, more skillful management is necessary to continue profitable production (*8*).

Tomatoes, string beans, cabbage, potatoes, sweetpotatoes, rhubarb, cucumbers, turnips, carrots, radishes, and sweet corn are grown to a limited extent as cash crops in some parts of the county. Many farmers in practically all the rolling parts grow some tomatoes. Cabbage is grown mostly in the valley between Dayton and Spring City, and string beans chiefly on soils of the colluvial slopes in the rolling parts. Most of the rhubarb, potatoes, carrots, cucumbers, and radishes are grown on Hartsells soils in the southern part of the county on the Cumberland Plateau. Corn for table use is grown in the valley and on some of the first-bottom lands along the river. Some of the corn, string beans, cabbage, and tomatoes is sold to canneries at Dayton and Spring City, and many of the vegetables are sold on the late summer market in Chattanooga or shipped to northern markets. According to the 1940 census, about 689 acres of vegetables exclusive of all potatoes were raised for sale in 1939. This represents a decided decrease from the 1929 acreage of 1,374 and from the 1934 acreage of 1,390. Very few places are operated for vegetables exclusively, as most of these are grown as secondary crops, supplementing the production of the more common field crops.

Apples, pears, plums, peaches, cherries, and grapes are common on many farmsteads, but few orchards have a significant commercial production. Apples and peaches are the chief orchard fruits. The average farm orchard is not well cared for, but the commercial orchards for the most part are maintained in good condition. Of the blackberries and blueberries harvested from the wild growth that commonly develops on abandoned fields, a few are shipped, but the greater part is consumed within the county. Huckleberries grow wild on the Cumberland Plateau and are sold at nearby markets.

LIVESTOCK AND AGRICULTURAL PRODUCTS

During the past 35 years the number of work animals has decreased considerably, and the number of hogs more than 50 percent. The number of cattle has not changed so strikingly, but the annual value of dairy products, and of poultry and eggs, including those for home use, increased several fold from 1899–1929. The number of sheep and goats has decreased considerably.

According to census data, there were 5,926 head of cattle over 3 months of age on farms on April 1, 1940, as compared with an increase of approximately 20 percent over the 4,878 on April 1, 1930. Most of these cattle were dairy animals, and considerable dairying, both as a specialty and as an adjunct to general farming, is carried on, especially in the valley between Dayton and Spring City, where abundant water for livestock is available and milk routes to Chattanooga are convenient. The soils of this valley in general are well suited to pasture and other crops essential to dairying. Some milk is consumed by the small local creamery and ice cream plant at Dayton. The value of dairy products sold has increased steadily from $6,518 in 1899 to $84,961 in 1939. There are a few beef cattle in the county, and farms producing them are widely distributed. Most of these cattle are grade Aberdeen Angus, Herefords, and Shorthorns.

A few hogs are raised on most farms, and the number remained approximately the same for a long period prior to 1920. The number decreased, however, from 5,824 as of January 1, 1920, to 2,362 (over 4 months of age) on April 1, 1940. It is thought that this decline represents an adjustment due to the balance between pork and corn prices, which determines whether the surplus corn is sold or fed to hogs. It is estimated that the production of pork about equals the consumption. Some hogs, however, are shipped to Chattanooga and northern markets, and some pigs to be fattened are shipped to Virginia and Alabama. The chief breeds are Hampshire, Poland China, and Duroc-Jersey.

The number of sheep has been decreasing in recent years, and according to the census, there were but 143 over 6 months of age as of April 1, 1940. Most of them are of mixed breed, and some are allowed to run on the open range on the Cumberland Plateau.

Chickens are an important source of cash income. There were 43,458 over 4 months old on farms April 1, 1940, as compared with approximately 40,000 April 1, 1930. Most chickens are raised in small farm flocks, although there are a few specialized poultry farms. Poultry and poultry products are collected by the rolling stores or

545846—48——2

are sold to merchants in exchange for groceries. Some poultry, however, is sold on the Chattanooga market, and a small quantity is shipped to northern markets. Rhode Island Red, Plymouth Rock, White Leghorn, and White Giant are the principal breeds.

On April 1, 1940, there were 1,290 mules and 630 horses over 3 months old in the county. A sharp decline in the number of these work animals occurred from 1920 to 1930, chiefly in the number of horses. Improved breeding stock is brought into the county from time to time.

The value of agricultural products by classes, as reported by the United States census for the years 1909, 1919, 1929, and 1939, is given in table 3.

TABLE 3.—*Value of agricultural products, by classes, in Rhea County, Tenn., in stated years*

Product	1909	1919	1929	1939
All cereals	$226,783	$816,173	$382,648	$260,297
Corn harvested for grain	(1)	(1)	361,157	244,046
Wheat threshed	(1)	(1)	15,568	7,595
Other cereals	(1)	(1)	5,923	8,656
Other grains and seeds	3,622	11,503	7,578	7,628
Hay and forage	117,992	312,243	135,297	223,632
Vegetables	65,653	190,795	216,408	131,779
For sale [2]	(1)	(1)	69,560	26,751
For farm households' use [2]	(1)	(1)	48,609	56,845
Potatoes and sweetpotatoes	(1)	(1)	98,239	48,183
Fruits and nuts	253,763	392,083	311,230	145,976
Horticultural specialties sold	(1)	(1)	975	14,550
Cotton	(1)	(1)	1,836	460
Tobacco	(1)	(1)	703	5,607
All other crops	73,571	15,259	5,850	3,682
Forest products sold	(1)	(1)	15,026	4,814
Livestock sold or slaughtered	185,251	(1)	(1)	111,347
Cattle and calves	(1)	(1)	(1)	59,742
Hogs and pigs	(1)	(1)	(1)	51,239
Sheep and lambs	(1)	(1)	(1)	366
Livestock products				
Whole milk, cream, and butter sold	18,711	30,755	93,198	84,961
Poultry and eggs produced	48,872	123,285	175,442	76,106
Wool shorn	690	499	344	84
Honey produced	[3] 1,103	[3] 5,155	400	1,299

[1] Data not available.
[2] Excluding potatoes and sweetpotatoes.
[3] Includes wax.

LAND USE CHANGES

The number of farms increased from 595 in 1880 to 1,247 in 1940, but the average size decreased from 215 to 93.9 acres. The decrease has been continuous, although somewhat more rapid during the first 10 years of this period than later. The proportion of improved land per farm increased from 34.6 to 58.4 percent from 1880 to 1940, but the actual acreage of improved land per farm diminished from 74.4 to 54.9. In 1910 there were only 46.3 acres of improved land on each farm. According to the 1940 census, 54.6 percent, or 117,098 acres, of land in the county was in farms. Throughout the period of agricultural development there has been a continuous trend to smaller farms. The size ranges from 3 to more than 1,000 acres, but mostly from 10 to 140 acres. The 1940 census reports 120 farms of less than 10 acres and 237 of more than 140 acres, with only 2 of more than 1,000 acres. The larger farms are along the river bottoms, in the valley east of the cherty ridges, and in the valley followed by the railroad. These

are the smoother more productive parts of the county and are most suitable for the use of heavy farm machinery. Land is held in relatively large tracts on the Cumberland Plateau, where much of it is too rough to be cropped. The smaller farms are common to the cherty ridges, the smoother areas developed over shale, and the immediate vicinity of villages, where many are of the subsistence type or are worked by part-time laborers.

FARM TENURE

Census data for 1940 show that 731 farms were operated by owners, 111 by part owners, 404 by tenants, and 1 by a manager. Of the tenants, 133 were croppers, the remaining 271 being classed as other renters. Croppers are share tenants to whom the landlord furnishes all equipment, work animals, and part of the fertilizer. There has been a trend from owner-operated farms to renter-operated; 70.9 percent were operated by owners in 1880; 67.5 percent by owners and part owners in 1940.

Croppers usually receive a third of the corn and hay and half the cash crops, which, in this county, for the most part are strawberries and other truck crops. The customary rental rates are on a basis of one-third each for the labor, the stock and tools, and the land. The fertile soils of the river-bottom lands rent for two-fifths to half of the crop. Expense of fertilizer and feed is commonly divided between landlord and tenant in proportion to their respective shares of the crop. Cash rents vary from $1 to $5 an acre.

The total expenditure for farm labor on 401 farms reporting in 1929 was $53,682. The largest expenditure in 1 year was over $109,000, in 1909, when 660 farms reported, as compared with 401, or about one-third of the total in 1939. Farm labor is mostly white and is hired by the day, month, or year. It is not uncommon for a landlord to furnish a house, fuel, garden plot, pasture for one or two cows, and some feed where the laborer is hired for relatively long periods. Wages are adjusted in accordance with the facilities furnished the laborer. In some cases the landlord boards and rooms the laborer in addition to paying a daily or monthly wage.

FARM INVESTMENTS

The average investment in all property for each farm, according to United States census data, increased from $2,830 in 1880 to $3,417 in 1940. The average investment in land, buildings, and machinery was about $2,500 in 1800 and about $3,000 in 1940. These items reached a maximum of about $4,900 in 1920. The 1940 census shows that about $360 to the farm was invested in livestock. The total value of farm property for each farm for 1940 averaged $3,417. Of this 85.6 percent represented land and buildings; 3.9 percent implements; and 10.5 percent domestic animals, poultry, and bees. The average acre value of land and buildings was $31.15.

The amount spent annually for fertilizer increased continuously from 1880 to about 1920, but thereafter dropped considerably. Only $1,832 was spent in 1879, $28,884 in 1919, and $18,512 in 1939. The purchase of fertilizer was reported by 762 farms in 1919 and by 519 in 1939. Some fertilizer is home-mixed, but a large part is ready-

mixed. Strawberries, truck crops, wheat, and corn, grown on soils of the upland, are the chief crops on which it is used. High-phosphate fertilizers and superphosphate alone are used to some extent under wheat and corn, and generally under alfalfa. Complete fertilizers (2–9–4[6] or 4–10–4) are commonly used on truck crops. In recent years considerable lime has been applied for leguminous crops, especially alfalfa and red clover. The census data show that 144 farms reported an expenditure of $4,460 for lime in 1940.

SOIL SURVEY METHODS AND DEFINITIONS

Soil surveying consists of the examination, classification, and mapping of soils in the field and the recording of their characteristics, particularly in regard to the growth of various crops, grasses, and trees.

The soils and the underlying formations are examined systematically in many locations. Test pits are dug, borings are made, and exposures, as in road and railroad cuts, are studied. Each excavation exposes a series of layers, or horizons, called collectively the soil profile. Each horizon, as well as the parent material beneath the soil, is studied in detail, and the color, structure, porosity, consistence, texture, and content of organic matter, roots, gravel, and stone are noted. The reaction of the soil and its content of lime and salts are determined by simple tests.[7] The drainage, both internal and external, and other external features, as the relief or lay of the land, are taken into consideration, and the interrelation of soil and vegetation is studied.

The soils are classified according to their characteristics, both internal and external, with special emphasis upon the features that influence the adaptation of the land for the growing of crop plants, grasses, and trees. On the basis of these characteristics they are grouped into classification units, the three principal of which are (1) series, (2) type, and (3) phase; and some areas—as riverwash and rough stony land—that have no true soil are called (4) miscellaneous land types.

The series is a group of soils having the same genetic horizons, similar in their important characteristics and arrangement in the soil profile and having similar parent material. Thus, the series comprises soils having essentially the same color, structure, natural drainage conditions, and other important internal characteristics, and the same range in relief. The texture of the upper part of the soil, including that commonly plowed, may vary within a series. The series are given geographic names taken from localities near which they were

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[6] Percentages, respectively, of nitrogen, phosphoric acid, and potash.

[7] The reaction of the soil is its degree of acidity or alkalinity, expressed mathematically as the pH value. A pH value of 7 indicates precise neutrality, higher values, alkalinity, and lower values, acidity. Terms that refer to reaction and are commonly used in this report are defined in the Soil Survey Manual (*5, p. 86*), as follows

	pH value
Extremely acid	Below 4.5
Very strongly acid	4.5–5.0
Strongly acid	5.1–5.5
Medium acid	5.6–6.0
Slightly acid	6.1–6.5
Neutral	6.6–7.3
Mildly alkaline	7.4–8.0
Strongly alkaline	8.1–9.0
Very strongly alkaline	9.1 and higher

The presence of lime in the soil is detected by the use of a dilute solution of hydrochloric acid.

first identified. Dewey, Fullerton, Clarksville, Talbott, and Hartsells are names of important soil series in Rhea County.

Within a soil series are one or more types, defined according to the texture of the upper part of the soil. Thus, the class name of this texture, as sand, loamy sand, sandy loam, silt loam, clay loam, silty clay loam, or clay, is added to the series name to give the complete name of the soil type. For example, Dewey silt loam and Dewey silty clay loam are soil types within the Dewey series. Except for the texture of the surface soil, these types have approximately the same internal and external characteristics. The soil type is the principal unit of mapping, and because of its specific character it is usually the unit to which agronomic data are definitely related.

A phase of a soil type is a variation within the type in some minor feature, generally external, that may be of special practical significance. Differences in relief, stoniness, and degree of accelerated erosion may be shown as phases. For example, within the normal range of relief for a soil type some areas may be adapted to the use of machinery and the growth of cultivated crops and others may not. Even though no important differences are apparent in the soil profile or in its capability for growing native vegetation throughout the range in relief, there may be important differences in respect to the growth of cultivated crops. In such instances the more sloping parts of the type may be segregated on the map as a sloping or a hilly phase. Similarly stoniness may be mapped as a phase, even though the differences are not reflected in the character of the soil or in the growth of native plants. Examples in the Dewey series are Dewey silty clay loam, eroded phase, and Dewey silty clay loam, severely eroded hilly phase.

The soil surveyor makes a map of the county or area, showing the location of each of the soil types, phases, complexes, and miscellaneous land types, in relation to roads, houses, lakes, section and township lines, and other local cultural and natural features of the landscape.

SOILS

Differences among soils in suitability for agricultural use have been important factors in bringing about local differences in the present agriculture of Rhea County. For example, the Huntington and Pope soils, which occur on the stream bottoms, are particularly well suited to corn production and are used chiefly for that purpose. Such use, in turn, has facilitated the production of livestock in areas where these soils are extensive. Other soils, as those of the Dewey, Fullerton, Etowah, Nolichucky, Sequatchie, Wolftever, and Allen series, have a wide range in use suitability and are capable of supporting widely diverse types of farming. These soils, used in combination with the Huntington, Pope, Lindside, and Philo soils, support a great number of the general farms and also many of the livestock and crop-specialty farms. On the other hand, it is on soils such as those of the Apison, Clarksville, and cherty types of the Fullerton, Hartsells, Muskingum, Hanceville, and Jefferson series that a large part of the subsistence farms are located. A number of farmers, however, by good management and thrift have built up farms on some of these soils beyond the subsistence level of the general region. Moreover, many of the special crops are produced on these soils; strawberries and peaches, for ex-

ample, are grown chiefly on the Fullerton and Clarksville soils, and potatoes on the Hartsells soils.

There is a fairly consistent relation between the suitability of a soil for agriculture and the general well-being of the people living on the land. The more progressive agricultural communities, as expressed by good farmhouses and other farm buildings, good fences, ample farm equipment, good schoolhouses, churches, and good local roads, are generally on areas a fairly large part of which consists of soils well suited to staple farm crops. Such communities are found where the Dewey, Allen, Etowah, Wolftever, Sequatchie, Huntington, Lindside, and Pope soils predominate. On the other hand, the poorer buildings, poorer fences, smaller and more irregular-shaped fields, and poorer schools and churches are generally, but not always, on soils that are not well suited to the present agriculture. This is particularly true on soils of the Colbert, Talbott, Clarksville, Apison, Jefferson, Hartsells, Muskingum, and Hanceville series, and on the cherty types of the Fullerton.

The variations of soils in such characteristics as color, texture, structure, consistence, fertility, and relief and in conditions of stoniness and erosion bear a close relation to productivity, workability, and conservability, all of which, in turn, determine the relative physical suitability of each soil for agricultural use.

The colors of the surface soils range from dark brown through yellow and gray to almost white, and as the color becomes lighter the content of organic matter and the fertility usually decrease. The colors of the subsoils range from brown through red and yellow to light gray. The soils having red or brown subsoils are usually more productive than those having yellow or gray subsoils.

The texture of the surface soils ranges from that of almost pure sand to clay. In nearly 32 percent of the county it is silt loam or loam; in about 13 percent silty clay loam or clay loam; and in about 50 percent sandy loam or loamy sand.

Most of the soils are well drained. Those that would be improved by artificial drainage cover somewhat less than 4 percent of the county.

Soils poorly suited to crops requiring tillage, because of one or more unfavorable characteristics, occupy about 46 percent of the county, or about 99,000 acres. Among the more important features that make these soils so poorly suited are strong relief, extreme stoniness, extreme erosion, poor drainage, and unfavorable consistence.

The soils on about 115,000 acres, or about 54 percent of the county, are fairly well suited to crop production. The relief on nearly half this area is nearly level or undulating. About three-fourths of it is almost stone-free, and on the rest the stoniness varies from small numbers to a sufficient quantity of stones to interfere seriously with cultivation. About one-third of this area has lost little or none of the soil by accelerated erosion.

The soils that have been in place for a long time are confined to the uplands and terraces. They have developed a genetic profile in an environment of moderately high temperature, heavy rainfall, and forest cover. For the most part, though less fertile than the young soils of the bottom lands and most soils of the western prairies, they are generally more fertile than comparable soils farther south and southeast, where the temperature is higher and leaching has been more severe. Even on the uplands, however, the soils differ widely in

fertility. The nature of the materials from which they have developed is strongly reflected in the degree of natural fertility as well as in other characteristics. During the years of cultivation, accelerated erosion and artificially stimulated processes of impoverishment have further intensified local variations in fertility and productivity.

As compared with average conditions in the Valley of East Tennessee, it is estimated that about 20 percent of the part of the land in Rhea County suited to cultivation is relatively high in natural productivity, about 30 percent is medium, and about 50 percent is relatively low. Although many of the soils that are at least fairly well suited to cultivation are developed from materials weathered chiefly from rocks rich in calcium and magnesium carbonates, most of those of the uplands are deficient in lime, practically all of which was lost by solution and leaching during the process of weathering and soil development. The content of organic matter was not high in the virgin soil, and much of that originally present has been lost through cultivation. Both quantity and kind of organic matter differ from place to place, even in the virgin state, and these differences are greater in cultivated soils. Many of the soils of the bottom lands are rich in lime, organic matter, and mineral plant nutrients.

Good tilth of the surface soils is easily obtained and maintained except on some of the silty clay loams, which are subject to puddling, surface baking, and clodding when tilled under adverse moisture conditions. With relatively few exceptions, such heavy-textured surface soils were originally subsoils that have been exposed through loss of the original surface soils by erosion.

SOIL SERIES AND THEIR RELATIONS

The method of classifying soils on the basis of their characteristics is explained in the section on Soil Survey Methods and Definitions. By this method the soils of Rhea County have been classified into 41 series and 7 miscellaneous land types. It is the purpose of this section to describe the soil series in such manner that each series name will call to mind the outstanding characteristics of that series. A convenient method of presentation is to associate each series with the position it normally occupies on the broad landscape in order that its name may picture its location with respect to the topographic features of the area.

Accordingly, the soil series are placed in four groups: Those that occur (1) on the uplands, (2) on colluvial lands, (3) on terraces, and (4) on bottom lands. By uplands is meant lands that lie at elevations higher than adjacent stream bottoms, stream terraces, and colluvial slopes. By colluvial lands is meant areas at the foot of mountains, ridges, or hills and in depressions, where rocks and soil material, moved from adjacent higher lands, have accumulated. Terrace lands and bottom lands are water-laid. The bottom lands comprise areas along streams that are subject to flooding; whereas the terrace lands, also called second and third bottoms, are benchlike areas that border the bottom lands but, occupying higher positions, are not subject to flooding.

The soil series are grouped according to topographic position, and their characteristics summarized, in table 4.

SOILS OF THE UPLANDS

The Colbert, Talbott, Dewey, Fullerton, and Clarksville series include the soils developed from limestone materials on the uplands. The outstanding differentiating characteristic of the Talbott and Colbert series is the tough plastic subsoil. The Colbert series differ from the Talbott in the color of the subsoil and in having more sticky and plastic consistence and shallower depth to bedrock. The Dewey, Fullerton, and Clarksville series are differentiated largely by colors of surface soils and subsoils, although other significant differences exist. The surface soils of the Dewey series are grayish brown; those of the Fullerton brownish gray; and those of the Clarksville light gray. The subsoils in the Dewey series are brownish red; in the Fullerton, pale red; and in the Clarksville, yellow. The natural fertility of the soil decreases from the Dewey to the Clarksville series; the quantity of chert and the resistance to erosion on similar slopes increase in the same order. Of the remaining nine series of the uplands, four are developed from shale materials and five from sandstone materials.

The Upshur, Conasauga, Apison, and Montevallo soils, developed from shale materials, are characterized by a relatively shallow depth to bedrock, at least moderately compact subsoils, and a marked susceptibility to erosion when tilled. The Upshur soils are developed over purplish calcareous shales and are characterized by their purplish brown color. The Conasauga soils are developed over calcareous shale with some interbedded limestone and resemble the Colbert soils. The Montevallo soils are developed over acid shale and are characterized by a hilly landscape and low natural productivity. The Apison soils are developed over sandy shale and commonly occupy valley positions. They are similar to the Conasauga soils in this respect but differ essentially in having a less tough subsoil.

The Hector, Hanceville, Muskingum, Crossville, and Hartsells soils, developed from sandstone materials, are characterized by shallow depth to bedrock and friable or open subsoils. The Hector soils are reddish, have a hilly to steep slope, and are very shallow to bedrock. Hanceville soils are reddish also, but have a smooth surface and moderate depth to bedrock. The Muskingum soils are yellowish, have a hilly to steep surface, and are very shallow to bedrock. The Hartsells soils are also yellowish, but have a smoother surface and a more uniform and moderate depth to bedrock. The Crossville soils resemble the Hartsells soils somewhat and are differentiated from them by their brown color.

COLBERT SERIES

Members of the Colbert series, locally called waxy land, are some of the heaviest textured soils in the county. They are developed from clayey limestones; and, like the associated Talbott soils, occupy floors of valleys underlain by limestone. In uneroded areas, the Colbert series have brownish-gray to grayish-brown moderately friable silt loam or silty clay loam surface soils 4 to 8 inches thick. The subsoil consists of yellow mottled with gray tough, tenacious, plastic, sticky, silty clay. The thickness of the subsoil generally ranges between 10 and 20 inches. The substrata are more highly mottled with gray than the subsoils. Depth to limestone is generally about 20 inches, but outcrops of limestone are common. The undulating to rolling relief of

soils of this series is mild. The external drainage is generally good; but the internal drainage is very slow, owing to the low permeability of the subsoils. These soils are difficult to work and to conserve and generally give low yields of the crops commonly grown in the county. A great part of the acreage is used for pasture.

TALBOTT SERIES

The soils of the Talbott series are underlain by clayey limestone, but the limestone is less clayey than that underlying the associated Colbert soils. The Talbott soils differ from the Colbert chiefly in being yellow-red instead of yellow in the subsoil, deeper to bedrock, less sticky and plastic, and better drained and aerated. In uneroded fields, the grayish-brown to brownish-gray silt loam to silty clay loam surface soil is 5 to 8 inches thick. The surface soil is generally friable. The subsoil consists of sticky and plastic silty clay 18 to 30 inches thick. It is yellowish red to light red in color and usually has a few splotches of gray and yellow in the lower part. The parent material below the subsoil consists of sticky and plastic silty clay similar to that in the subsoil, but it is highly mottled and splotched with gray and yellow. This material rests on uneven or jagged bedrock at an average depth of about 5 feet. Small outcrops of bedrock are common, particularly where the soil is eroded. The greater part of this series is so eroded that the upper part of the yellowish-red subsoil is brought to the surface by tillage, and in such places the plowed soil is tinged with red. Members of this series that are gently sloping and not greatly eroded are fairly well suited to crop production and are moderately productive under ordinary management. They are highly susceptible to erosion, especially where slopes are strong.

DEWEY SERIES

The Dewey soils differ from the Talbott chiefly in having more friable subsoils and generally much greater depth to bedrock. They are underlain by high-grade dolomitic limestone. In uneroded fields the grayish-brown mellow silt loam surface soil is about 10 inches thick. The subsoil extends to depths of 40 to 60 inches and consists of red or brownish-red firm but friable silty clay. The parent material is dominantly yellow sticky and plastic silty clay splotched with brown, ocherous yellow, and gray. The soil in eroded areas has a reddish surface layer and is more difficult to maintain in good tilth than in uneroded areas. In general, Dewey soils are productive of most of the crops common to the region.

FULLERTON SERIES

The Fullerton soils are related to the Dewey, but differ chiefly in having lighter colored surface soils, paler red subsoils, and more cherty parent material. The Fullerton soils are derived from cherty dolomitic limestone materials, and the soils themselves are highly cherty in many places. In contrast to the Colbert, Talbott, and Dewey soils, which are mostly in the limestone valleys, the Fullerton soils generally are on the cherty ridges. In uneroded fields the surface soil extends to a depth of about 10 inches and consists of friable brownish-gray silt loam that is cherty in most areas. The yellowish-red to light-red firm but friable silty clay loam or silty clay subsoil

extends to a depth of about 40 inches and contains a moderate quantity of chert fragments. The parent material is a yellow tough cherty silty clay, splotched with reddish brown, ocher, and gray. The depth to bedrock is probably 30 feet or more in places. Soils of this series range from undulating to hilly and their suitability for use varies widely with the relief (fig. 3, *A*). The undulating and rolling Fullerton soils are generally fairly well suited to crop production (fig. 3, *B*); the hilly and steep ones are not, although they are ordinarily suitable for pasture. In relation to the other soils of the county, these soils seem to be about medium in fertility.

CLARKSVILLE SERIES

The Clarksville soils, locally called white gravelly land, are developed from weathered products of very cherty dolomitic limestone and are easily identified by the cheritness, nearly white surface soils, and yellow subsoils (fig. 3, *C*). They are mostly on the cherty ridges in association with the Fullerton soils and are distinguished from the Fullerton series by their yellow subsoils. The gray silt loam surface soil and the yellow friable silty clay loam subsoil are generally cherty. At a depth of about 40 inches the subsoil is underlain by parent material consisting of a predominantly yellow cherty silty clay splotched with reddish brown, ocher, and gray, with chert fragments in some places. Bedrock of jagged grayish dolomitic limestone is at depths of 10 to 30 feet. The relief ranges from rolling to steep. These soils are low in fertility, and under ordinary management are generally low in productivity of such crops as corn, small grains, and legumes but appear to be well suited to strawberries and certain vegetables. Chert fragments and steep slopes make cultivation difficult, but these soils are not highly susceptible to accelerated erosion.

UPSHUR SERIES

The Upshur soils are developed from purplish calcareous shale material. The 8-inch surface soil of uneroded areas is purplish-brown silt loam underlain by a dull-red firm but moderately plastic silty clay to a depth of about 10 inches. The lighter colored material, from 10 to 30 or 40 inches, is mottled purplish-red, yellow, gray, and brown silty clay. Bedrock calcareous shale lies at a depth of 2 to 4 feet. Most of these soils have a rolling to hilly relief, and a great part of the acreage lies on the southeast-facing slope of the low ridge between the Southern Railway and the Cumberland escarpment. These soils are of fairly high fertility but require careful management from the standpoint of water control.

CONASAUGA SERIES

The Conasauga soils, developed from calcareous shales and some interbedded limestone, occupy undulating to gently rolling valley areas. The 4- to 8-inch surface soil is friable brownish-gray to grayish-brown silt loam or silty clay loam. Below this depth and extending to about 15 inches is yellow mottled with gray tough tenacious silty clay that grades to tenacious plastic mottled yellow and gray clay. In places bedrock lies at a depth of about 20 inches. The total acreage is not large; the largest area is about 3 miles south of Spring City.

FIGURE 3.—A, The Fullerton soils are rolling to hilly, and most of the acreage is cleared and after being planted to corn, hay, and wheat for several years is used as unimproved pasture. View 1 mile east of Pleasant Dale School east of Evensville. *B*, A comparatively smooth area of Fullerton and Greendale soils in the same locality as above. Lespedeza hay, corn, and pasture are the chief crops grown. *C*, Clarksville soil 1 mile west of Pleasant Dale School. These soils are of low fertility, cherty, and for the most part hilly.

These soils are of relatively low fertility and present serious problems of conservation when tilled.

MONTEVALLO SERIES

The Montevallo soils, developed from acid shale material, resemble the Conasauga in color, but are more friable and have a more hilly relief. The surface 6 inches is yellowish-gray friable silt loam, and the 18-inch subsoil is brownish-yellow firm silty clay loam or silty clay. Bedrock of variegated yellow, gray, and purplish soft shale is at a depth of about 20 inches. The total area is small, and most of it is in the vicinity of New Bethel Church. These soils are of low fertility and under present management practices are not well suited to crops.

APISON SERIES

The Apison soils have developed from weathered products of interbedded acid fine-grained (silty) shale and sandy shale characterized by mixed yellow, gray, and purple colors, all of which are conspicuous in deep road cuts. They are chiefly on gently sloping valley areas associated with ridges of Montevallo and Muskingum soils of the Valley and Ridge physiographic province. In uneroded fields the 6- to 8-inch surface soil consists of yellowish-gray friable very fine sandy loam, and the brownish-yellow firm but friable sandy clay loam subsoil is about 12 inches thick. Below this layer is variegated yellowish-brown, red, and gray sandy clay containing numerous fragments of weathered shale. Depth to bedrock is from 30 to 40 inches. These soils are of low fertility, and their proper management for the production of tilled crops presents serious conservation problems.

HECTOR SERIES

The Hector series includes hilly to steep reddish soils developed from acid sandstone. Below the grayish-brown to brown fine sandy loam 4-inch surface soil is a red firm but friable fine sandy loam layer of variable thickness. Partly weathered bedrock sandstone lies at a depth of 10 to 40 inches. Most of these soils are along the lower part of the Cumberland escarpment. They are not well suited to tilled crops, chiefly because of slope and shallow depth to bedrock.

MUSKINGUM SERIES

The steep, stony, and sandy Muskingum soils are derived from weathered material of sandstone and conglomerate, containing a few thin strata of acid shale, and occupy the rougher parts of the Cumberland Plateau. In many places the yellow to brownish-yellow profile shows practically no distinct surface soil and subsoil layers. In places where discernible surface soil and subsoil layers have developed, the surface soil consists of grayish-brown loose fine sandy loam, and the subsoil of yellowish friable sandy clay. Sandstone fragments are common, both on the surface and in the soil. Depth to bedrock is generally less than 15 inches. These soils are poorly suited to crop production or to pasture in the present agriculture, and most of their acreage is covered with forest.

HARTSELLS SERIES

The Hartsells soils, the main soils of the undulating areas of the Cumberland Plateau, are derived chiefly from weathered sandstone with which a small quantity of weathered acid shale is interbedded. The 8-inch surface soil consists of brownish-gray to yellowish-gray loose fine sandy loam, and the yellow to brownish-yellow friable sandy clay loam subsoil is about 20 inches thick. Depth to sandstone bedrock is generally about 40 inches. The soils are free from stones in nearly all places. They are light-textured and easy to work but naturally low in fertility and, though generally considered suitable for crop production, large parts are still in forest. These soils lie at an elevation of approximately 2,000 feet, which is about 1,000 feet higher than the Valley and Ridge province.

CROSSVILLE SERIES

The Crossville soils are closely associated with the Hartsells and the Muskingum. They differ from the Hartsells chiefly in having a browner color throughout the profile and a somewhat shallower depth to sandstone bedrock. The 10-inch surface soil is grayish-brown friable fine sandy loam to loam underlain by yellowish-brown friable loam to clay loam variegated in color below a depth of about 18 inches. Bedrock of sandstone that generally includes some shale is at a depth of 24 to 30 inches. These soils have an undulating to rolling relief, are easily worked, and are suited to the production of the crops grown on Hartsells soils.

HANCEVILLE SERIES

The Hanceville series are rolling reddish soils developed from acid sandstone and differ from the Hector chiefly in having a greater depth to bedrock, a more mature profile, and a smoother surface. The 10-inch surface soil is yellowish-gray to grayish-brown fine sandy loam. Below this is reddish-yellow friable sandy clay loam that becomes redder below a depth of about 20 inches. Bedrock is at a depth ranging from 30 to 50 inches. The use-suitability and management requirements approximate those of the Hartsells soils. The aggregate area is not great, and most of it is on narrow ridges and near the rim of the Cumberland Plateau.

SOILS OF THE COLLUVIAL LANDS

The soils of the colluvial lands are developed from both colluvium and local alluvium, mixed or alone. Of the eight series in this group, the Allen and Jefferson are developed on colluvium and local alluvium derived for the most part from sandstone washed chiefly from the Hartsells, Muskingum, and geographically associated soils. The Emory, Greendale, and Burgin are developed on colluvium and local alluvium derived for the most part from limestones. The Abernathy, Ooltewah, and Guthrie soils are developed on local alluvium derived chiefly from limestones and differ from the Emory, Greendale, and Burgin in occupying closed depressions, as sink holes.

ALLEN SERIES

The Allen soils are characterized by the red color of the subsoils, which readily distinguishes them from the associated yellow Jefferson soils. The surface soils and subsoils are variable; but in most places the surface soil is grayish-brown friable very fine sandy loam about 8 inches thick and the subsoil is red firm but friable sandy clay about 30 inches thick. In many places sandstone fragments and cobbles are common on the surface and throughout the soil mass. These soils are undulating to sloping and are at the foot of slopes occupied by Muskingum and Hector soils. In places not too stony the soils are fairly well suited to most of the crops grown in the county and are moderately productive.

JEFFERSON SERIES

The Jefferson soils are characterized by the brownish-yellow subsoils, by which they are easily distinguished from the associated reddish Allen soils. The degree of development of surface soil and subsoil layers is not uniform. In places where the colluvial material from which the soils are derived is of recent deposit, the soils have practically no distinct surface soil and subsoil layers; but where the colluvial material is rather old, these layers are well defined. In such places the surface layer is grayish-brown loose fine sandy loam 8 to 14 inches thick and the subsoil brownish-yellow friable clay loam about 20 inches thick. Sandstone fragments and cobbles are common on the surface and throughout the soil mass in the stony phases. These soils are nearly level to sloping and are along the drainageways associated with, or at the foot of, slopes occupied by Muskingum and Hector soils. In some places these soils are suitable for crop production, but in others such use is prohibited by stoniness. They are apparently lower in natural fertility than the Allen soils.

EMORY SERIES

The Emory soils are developed from colluvial-alluvial material washed for the most part from areas of Dewey, Cumberland, and the redder areas of the Fullerton, and are therefore closely associated with these soils. They are distinguished from the Greendale by reddish rather than yellowish color. The surface material to a depth of about 12 inches is brown friable silt loam and is underlain by reddish-brown or yellowish-brown silty clay loam that grades to lighter variegated material below a depth of about 3 feet. These are among the most productive soils of the county and are suited to a wide variety of crops.

GREENDALE SERIES

The Greendale series includes soils developed on colluvial-alluvial material washed for the most part from areas of Clarksville and the lighter red Fullerton soils and therefore is closely associated with these. The surface material to a depth of about 10 inches is yellowish-gray silt loam. The subsoil to about 20 inches is brownish-yellow cherty clay loam. Below this is mottled yellow and gray cherty silty clay. A variable quantity of chert is present throughout the soil mass. The relief is gently sloping to sloping, and most of

the areas are suited to the production of most general farm crops and certain truck crops.

BURGIN SERIES

The material of the Burgin soils has been washed for the most part from areas of Colbert soils and rolling stony land (Colbert soil material). The 10-inch surface soil is dark-brown silty clay loam, and the subsoil is mottled bluish-gray and yellow plastic clay. These soils have a neutral reaction and a shallow depth to bedrock limestone. Most areas are very gently sloping. They are fertile, but their suitability is limited by slow internal drainage and unfavorable consistence.

ABERNATHY SERIES

The Abernathy soils are composed of colluvial-alluvial material in depressions and near the head of small drainageways and are associated chiefly with Dewey and Cumberland soils. They are well drained mostly through subterranean channels. The soils consist of brown silt loam to a depth of about 30 inches, below which the material is mottled. They are very productive, and their use-capability apparently is similar to that of Huntington soils of first bottoms.

OOLTEWAH SERIES

The Ooltewah soils occupy sites similar to those of the Abernathy but, though not so well drained, are better drained than the Guthrie, which occupy similar positions. The surface layer is grayish-brown silt loam to a depth of 8 to 16 inches, below which are yellow and gray mottlings that become numerous with depth. These soils are very productive of corn and hay but are poorly suited to fall-sown annual crops.

GUTHRIE SERIES

The Guthrie soils differ from the Abernathy and Ooltewah chiefly in that they are too poorly drained for the successful production of most crops commonly grown. They have a friable silt loam surface soil underlain by sticky gray compact clay.

SOILS OF THE TERRACES

The nine soil series of the terraces are developed on old alluvial benches or terraces. The material from which the Cumberland, Etowah, Wolftever, Taft, and Robertsville series were developed was washed largely from uplands underlain by limestone, the Cumberland and Etowah are on high and intermediate terraces; the Wolftever, on low terraces; and the Taft and Robertsville, chiefly on low but to some extent on the higher terraces. The material from which the Waynesboro, Nolichucky, Holston, and Sequatchie series were developed was washed largely from uplands underlain by sandstones and shales. The Waynesboro and Nolichucky are on high terraces; the Holston chiefly on high and intermediate terraces; and the Sequatchie on low terraces.

CUMBERLAND SERIES

The Cumberland soils are on old high alluvial terraces composed for the most part of material washed from soils overlying limestone.

They are characterized by 10-inch brown silt loam surface soil and a red to brownish-red firm but friable silty clay subsoil. Some areas contain an appreciable quantity of gravel. The relief of most of the acreage is undulating to sloping, although an appreciable part is strongly sloping or hilly. The smoother areas are among the soils better suited to general farm crops.

ETOWAH SERIES

The Etowah soils are developed chiefly on intermediate and high terraces, but the parent material is similar to that from which the Cumberland soils were developed. In some respects, especially color, the Etowah soils resemble the Dewey soils. The 10-inch surface soil is grayish-brown silt loam. The subsoil to a depth of about 30 inches is yellowish-brown to reddish-brown friable silty clay loam. Below this the material is variegated or mildly mottled. The relief is undulating to sloping, and practically all the acreage is well suited to the production of the general farm crops commonly grown.

WOLFTEVER SERIES

The Wolftever soils are developed on low terraces composed for the most part of material washed from soils underlain by limestone. They are less well drained than are the Etowah and in places are subject to inundation by exceptionally high floods. They are distinguished from the Etowah by lighter brown color, more compact subsoil, and a mottled condition below a depth of about 22 inches. The 7-inch surface soil is brownish-gray silt loam, and the upper subsoil is moderately compact yellowish-brown silty clay loam. Those soils in general are less productive than the Etowah, and their use suitability is more limited.

TAFT SERIES

The Taft soils differ from the Etowah and Wolftever, with which they are commonly associated, chiefly in characteristics influenced by impaired drainage. They occupy smooth parts of the terraces, particularly along drainageways. The gray and friable surface layer is about 8 inches thick; the subsoil is yellowish-gray moderately mottled with gray silty clay that grades into plastic silty clay. The productivity is medium, and the suitability is limited chiefly to corn, certain hay crops, and pasture.

ROBERTSVILLE SERIES

The poorly drained soils associated with the Cumberland, Etowah, and Wolftever soils are of the Robertsville series. They occupy nearly level depressions, for the most part on the intermediate and low terraces. The surface soil is gray and friable, and the subsoil is gray mottled with yellow and brown moderately compact silty clay. These soils are poorly suited to crops requiring tillage.

WAYNESBORO SERIES

The Waynesboro soils are on old high terraces and are characterized by a brown to grayish-brown sandy to very fine loam surface soil and a brownish-red subsoil. They have less red in the subsoil, have an appreciable quantity of sand in the surface soil and subsoil, and

are less fertile than the Cumberland soils. The 8-inch surface soil in uneroded areas is predominantly very fine sandy loam, and the subsoil is moderately friable clay loam. A part of the acreage is gravelly. The relief for the most part ranges from undulating to sloping, although an appreciable acreage is strongly sloping or hilly. Except where severely eroded, the less sloping part is well suited to crops.

NOLICHUCKY SERIES

The Nolichucky soils, like the Waynesboro, are on old high terraces, but are distinguished by gray surface soils and reddish-yellow subsoils. The 8-inch surface layer is gray and loose, and for the most part is fine sandy loam. The subsoil is reddish-yellow firm but brittle sandy clay. A part of the acreage is appreciably gravelly. The relief for the most part is undulating to sloping, although a limited acreage is strongly sloping or hilly. These soils are of low fertility, but large parts are used for crops.

HOLSTON SERIES

The Holston soils are easily distinguished from the Waynesboro and Nolichucky by their yellow, as contrasted with reddish, subsoils. The 12-inch surface layer consists of gray loose fine sandy loam. The subsoil is 10 to 20 inches thick and consists of yellow firm but friable sandy clay. The sandy material below the subsoil is generally mottled yellow and gray. The soils are low in fertility, but their physical character and the lay of the land are favorable to cultivation.

SEQUATCHIE SERIES

The Sequatchie soils are of undulating relief on low terraces and are sandy and friable throughout the profile. Most of the material from which they have developed apparently was derived from upland underlain by sandstone and limestone. They are predominantly light brown, and the differences in both color and texture of the surface soils and subsoils are only slight. The 10-inch surface soil consists of grayish-brown friable fine sandy loam to loamy fine sand. The 24-inch subsoil is yellowish-brown or reddish-brown firm fine sandy loam or sandy clay loam. These soils are easily cultivated and are of medium productivity for most of the crops of the county.

SOILS OF THE BOTTOM LANDS

The 10 soils of the bottom lands are composed of young alluvial material. Their classification is greatly influenced by the character of the parent materials and drainage conditions. The Huntington, Lindside, Egam, Roane, Melvin, and Dunning consist of material washed chiefly from soils overlying limestone; the Pope, Philo, and Atkins chiefly of material washed from soils overlying sandstones and shales; and the Staser chiefly of sandy material strongly influenced by lime-bearing water.

HUNTINGTON SERIES

The Huntington soils are characterized by rich-brown silt loam or fine sandy loam 30-inch surface soils underlain by firm but friable material ranging in texture from silty clay loam to sandy loam to a depth of 3 to 4 feet, below which the material is generally highly

mottled with yellow and gray. These soils are fertile and of smooth relief but subject to occasional flooding. Chiefly because of this condition, their adaptability is somewhat limited. They are, however, particularly productive of corn, barley, and many hay crops.

LINDSIDE SERIES

The Lindside soils, intermediate in drainage between Huntington and Melvin, consist of brown mellow fine-textured silt loam to a depth of about 10 inches, below which the material is mottled with yellow and gray, the mottlings increasing with depth. Like the Huntington, these soils are fertile and while well suited to corn, hay, and pasture, they are not well suited to the production of many crops because of impaired drainage and susceptibility to flooding.

EGAM SERIES

The Egam series differs from the Huntington chiefly in having a compact layer at a depth of about 15 inches. The surface layer is grayish-brown friable silty clay loam, and the compact layer is dark-brown to nearly black silty clay. These soils are less well drained than are the Huntington and are a little more susceptible to flooding. Most of the acreage is cropped, but its use is limited chiefly to corn and some hay.

ROANE SERIES

The Roane soils, associated with the Clarksville and Fullerton, are easily distinguished from other soils of the bottom lands by chertiness. They are characterized by a tightly embedded or semicemented layer of chert fragments 6 inches or more thick at a depth of about 12 to 30 inches. The material above this layer is generally grayish-brown friable silt loam, in many places cherty. These soils are fairly well drained, but most of the areas are subject to occasional overflow and to soil alterations that result from scouring and deposition of new materials. The soils are moderate to low in fertility, but are fairly well suited to crop production and are important in the agriculture of many areas where the proportion of land physically well suited to crops requiring tillage is small.

MELVIN SERIES

The Melvin soils are poorly drained and fine-textured, and to a depth of about 12 inches are brownish gray faintly mottled with yellow and brown. Below this is highly mottled silty clay. Occupying gentle depressions or nearly level areas, they are very susceptible to flooding and unless artificially drained are best suited to pasture.

DUNNING SERIES

The Dunning soils, associated chiefly with Colbert and Talbott, are on first-bottom lands subject to flooding. The surface 22 inches is very dark gray resting on mottled material. The entire soil mass is plastic tough clay or silty clay. These are among the few soils neutral to slightly alkaline in reaction. They are very fertile, but chiefly because of unfavorable moisture relations and unfavorable consistence they are not well suited to crops requiring tillage.

STASER SERIES

The Staser sandy soils of first-bottom lands lie as natural levees along the bank of the Tennessee River. To a depth of about 6 inches the material is brown loamy fine sand, below which may be dark-gray or nearly black loamy fine sand extending to a depth of several feet. Where this darker layer is absent, the material grades to lighter brown loamy sand. The areas of these soils lie a little higher than the adjoining soils of the first bottoms and are subject to inundation only by the greater floods. Most of the acreage is cropped to corn and hay, but yields are much lower than on Huntington soils.

POPE SERIES

Most of the material of the Pope soils has been washed from upland underlain by sandstone and shale, and a great part of it is in the Cumberland Plateau. These soils are relatively well drained but subject to flooding. The texture ranges from loamy fine sand to silt loam, the sandier areas having the better internal drainage. The surface soil to a depth of about 12 inches is friable and brown or dark brown. Below this the color is lighter, and mottlings of gray and brown are common 30 to 50 inches below the surface. These soils are less productive than are the Huntington, but are well suited to and commonly used for corn and certain hay crops as well as pasture.

PHILO SERIES

The Philo soils, associated with Pope and Atkins, differ from the Pope soils chiefly in being imperfectly rather than well drained. The material to a depth of 20 inches is grayish brown to dark brown and friable, and below this it is mottled gray, yellow, and brown. The texture ranges mostly from fine sandy loam to silt loam. These soils for the most part lie lower than the Pope and are therefore more subject to overflow. They are less productive, and their suitability is more limited.

ATKINS SERIES

The Atkins soils are poorly drained and are commonly associated with the Pope and Philo, and like the Melvin they are predominantly grayish and mottled and often are subject to flooding. They are poorly suited to tillage but are of value for pasture on the Cumberland Plateau, where few soils are suited to this use.

SOIL ASSOCIATIONS

Soil associations may be defined from either of two points of view. Each may be considered as a group of soils occurring together in a characteristic pattern; or as a kind of landscape definable as to the kind, proportion, and distribution of its component soils. In either case a soil association may consist of only a few or of many soils. Those soils may all be similar or they may represent differing types. In all soil associations, however, there is a certain uniformity of soil pattern.

The degree of uniformity within a given soil association depends largely upon the scale of the map and the degree of detail followed in its preparation. Soil associations can be outlined so that they have a high degree of uniformity in pattern, but the maps showing those associations in most areas are rather detailed. Under such conditions,

the definitions and descriptions of the associations can be made relatively specific. Soil associations can also be outlined broadly on a map of small scale and thus have a low degree of uniformity. Choice of a level of uniformity or degree of detail in a soil association map should be based on the purpose for which the map is made. In any event the degree of uniformity obtainable in the soil association map depends upon the sources of information that are at hand. If a thorough knowledge of the individual soils and a detailed soil map are available, good soil association maps can be prepared at a number of different levels of generalization.

The proper uses of soil association maps differ from those of detailed soil maps. For example, soil association maps cannot provide sufficient information for the study of individual farms or for the planning of farm operations. Like other simplified or generalized soil maps they serve especially in giving a picture of the soils of the larger area, such as a community, a county, a State, or the Tennessee Valley. Soil association maps promise to be useful in regional studies of agricultural production or of the changes and adjustments that may be necessary in such production.

Ten soil associations have been recognized in Rhea County (fig. 4). Two of these, the Hartsells-Muskingum and Muskingum-rough stony land associations, are part of the physiographic region known as the Cumberland Plateau. The others are in the Valley and Ridge province, and seven of them lie in belts extending roughly northeast-southwest across the county. These seven are the Jefferson-Clarksville-Upshur, the Talbott-Allen-Lindside, the Sequatchie, the Clarksville-Fullerton, the Talbott-Colbert-Waynesboro, the Muskingum-Apison, and the Conasauga associations. These nine tend to follow exposures of geologic formations. The one association in the Valley and Ridge province that does not follow exposures of geologic formations is the Huntington-Wolftever-Sequatchie. These soil associations are defined and described in the following pages in terms of the proportions and patterns of the different soils and their present and potential uses in agriculture are briefly discussed.

HARTSELLS-MUSKINGUM

The Hartsells-Muskingum soil association (1 on the map, fig. 4) occupies the ridge tops or smoother parts of the Cumberland Plateau. The surface is mostly smooth, undulating, or rolling, although there are irregular strips of steep stony land along the major drains. The elevation above sea level ranges from about 1,400 to 1,900 feet, and above the valleys of the adjoining Valley and Ridge province, from 700 to 1,000 feet. The drainage system is sufficiently well developed to afford good surface drainage, and internal drainage for the most part is good. The only areas not well drained are small irregular tracts at the heads of some of the drainageways and along some of the drains where general alluvium has accumulated.

The soils, chiefly developed from and overlying sandstone of the Pennsylvanian system, are sandy and have a relatively shallow depth to bedrock. In general, in the smoother areas this depth is 18 to 40 inches, although the more sloping parts are very shallow and on the steeper slopes frequent rock outcrops are common. Soils of the Hartsells series occupy about 50 percent of the area and for the most part

are suitable for crops that require tillage. They are of fair to moderate productivity, are easily worked, and do not present serious problems of conservation except on the more sloping relief. The most extensive areas of this association are in the vicinity of and south of Morgan Springs. Much of this part is cleared and used for general farm crops, including corn, lespedeza, soybeans, and small grains. Certain truck crops, as potatoes, sweetpotatoes, and beans, are commonly raised, and much of these products is sold on the Chattanooga market. Of the remaining acreage represented by this soil association, much is forested, and a large part of the forested acreage can probably be considered potential agricultural land.

MUSKINGUM-ROUGH STONY LAND

The Muskingum-rough stony land soil association (2 on the map) represents the steeper parts of the Appalachian Plateau physiographic province, and the rocks are chiefly of the Pennsylvanian system. It consists for the most part of the so-called Cumberland escarpment, which lies as a steep rocky strip along the southeast face of the Appalachian Plateau province, and of the steep stony V-shaped valleys cut by the main streams. The Cumberland escarpment rises about 700 feet above the adjoining valleys of the Valley and Ridge province, and many of the steep rocky slopes near the streams rise 500 to 700 feet above them. The soils of this association for the most part are steep, rocky, and of very irregular and shallow depth to bedrock. They are of little or no agricultural value and consequently are best suited to forest or associated uses. Practically all the acreage of this association is forested by hardwoods and mixed hardwoods and pine.

JEFFERSON-CLARKSVILLE-UPSHUR

The Jefferson-Clarksville-Upshur soil association (3 on the map) lies as an irregular broken strip directly southeast of and parallel to the Cumberland escarpment. Its most striking feature is the broken and rather rugged ridge that lies about 200 feet above the adjoining valley in which the villages of Dayton and Spring City are located. This ridge is an outcropping of the Fort Payne chert and the Chattanooga and Clinton shales. The Clarksville soils have been mapped on the Fort Payne chert, and the Upshur soils on the Clinton shale. Between this broken ridge and the Cumberland escarpment is an irregular discontinuous strip of colluvial soils, which lie in valleys paralleling the Cumberland escarpment, the drainageways of which are tributaries to the larger streams that flow from the Appalachian Plateau across the county to the Tennessee River. The surface of these colluvial areas is sloping to hilly, and internal drainage for the most part is good. In the eastern extremity of the county and about 2 miles south of the junction of White Creek and the Tennessee River, is an area of steep, narrow ridge land about 2½ miles long, occupied chiefly by soils of the Upshur and Hector series, the parent rocks of which are of the Juniata and Sequatchie formations. Most of the acreage of the ridges of this association are forested and not well suited to crops. They are of relatively low productivity and difficult workability and present difficult problems of conservation. Probably two-thirds of the acreage of the Upshur soils, however, are sufficiently productive to be suitable

for pasture. The soils on the colluvial areas, which are mostly of the Jefferson series, have a considerable part of their acreage cleared for agricultural purposes. They are of limited productivity, however, and support a subsistence type of farming.

TALBOTT-ALLEN-LINDSIDE

The Talbott-Allen-Lindside soil association (4 on the map) lies as a valley (fig. 5, *A* and *B*) the average elevation of which is 700 to 800 feet. It lies directly southeast of and parallel to the Jefferson-

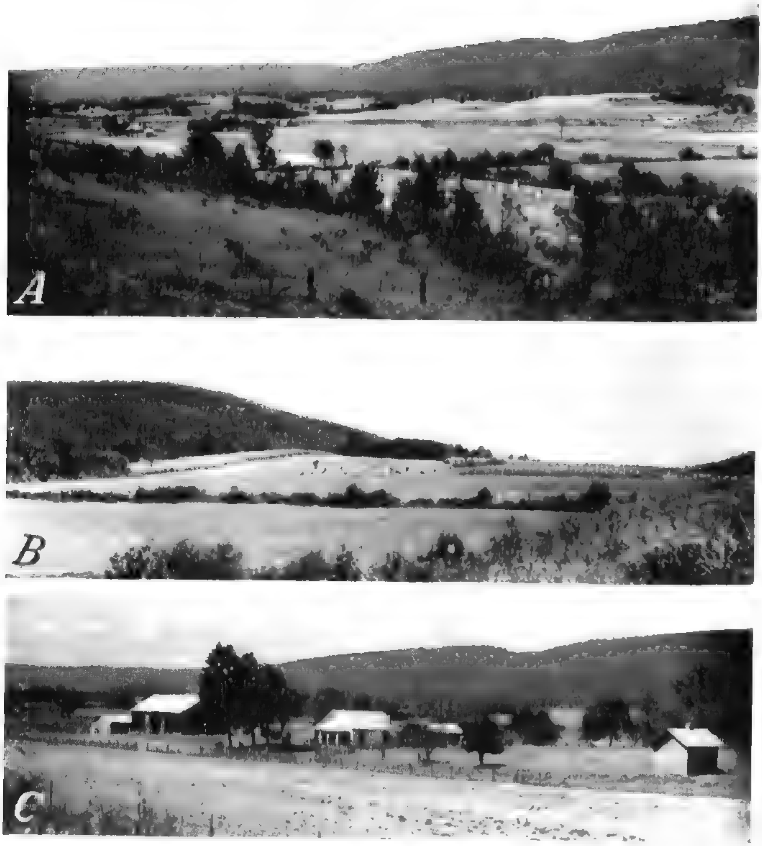

FIGURE 5.—*A*, General view of the valley between the Cumberland escarpment (in the background) and the cherty ridges (in the foreground), 3½ miles northeast of Spring City, looking southwest. The valley ranges from one-fourth to three-fourths of a mile in width, extends the entire length of the county, and is representative chiefly of the Talbott-Allen-Lindside soil association. *B*, General farm crops of corn, lespedeza, and small grains occupy a large part of the acreage of Allen, Jefferson, and Sequatchie soils. The forest is on hilly Muskingum soils, most of the acreage of which is too steep, rocky, and low in fertility to be well suited either to crops or to pasture. View 5 miles northeast of Spring City. *C*, A homestead near Spring City in a valley represented by the Talbott-Allen-Lindside soil association and lying between the Cumberland escarpment and the cherty ridges. General farming, including livestock and some truck crops, is common in this part of the county.

Clarksville-Upshur soil association and ranges from one-fifth to one-half mile in width. The underlying rock for the most part is argillaceous limestone of the Chickamauga formation. The relief is undulating to rolling, and the internal drainage, except for first bottoms along drains and streams, is good. Most of the soils are developed from material derived from argillaceous limestone, but an appreciable acreage has developed from old colluvium washed presumably from soils of the Cumberland Plateau. This soil association represents one of the most productive sections of the county (fig. 5, *C*). The soils are mostly of moderate to high productivity, and a large part of the acreage is suitable for crops requiring tillage. There are limited areas too stony or too steep to permit tillage, but practically all this land is sufficiently fertile to make it useful for pasture. Much of the acreage is cleared and used for crops and pasture. A mixed type of farming, including dairying and truck crops, is common to this area.

SEQUATCHIE

The Sequatchie soil association (5 on the map) represents the nearly level alluvial areas along the major streams that flow across the county from the Cumberland Plateau to the Tennessee River (fig. 6, *A*). The largest area of this association is along Piney River, and a considerable part of it is now inundated by Watts Bar Reservoir. The soils are chiefly of the Sequatchie series, and the material has been washed mostly from soils of the Cumberland Plateau. These areas are nearly level or smooth, internal drainage is good, but part of the acreage is subject to overflow. The sandier soils are of low productivity, but the more loamy areas are well suited to crops. A large part of the acreage is cleared, and much of this, except the most stony and most sandy areas, is used as cropland chiefly for corn, hay, and truck crops.

CLARKSVILLE-FULLERTON

The Clarksville-Fullerton soil association (6 on the map), one of the more extensive within the county, lies as a broad ridge-land strip directly southeast of and parallel to the Talbott-Allen-Lindside association (fig. 6, *C*). The underlying rock for the most part is dolomitic limestone of the Knox formation. The surface is dominantly rolling to hilly, but some areas have a hilly to steep relief (fig. 6, *B*). The average elevation is about 200 feet, and the higher ridges are about 250 feet above the area represented by the Talbott-Allen-Lindside association. The drainage system is of a dendritic type, modified by sinkholes and subterranean outlets. Both surface and internal drainage are good. Fertility ranges from fair to good, and depth to bedrock is usually more than 10 feet. The Clarksville soils predominate, their aggregate area being more than twice that of the Fullerton soils. About 10 percent of the acreage is of Second-class soils, 45 percent Third-class soils, 40 percent Fourth-class soils, and 5 percent Fifth-class soils (see section on Physical Land Classification, p. 119). A considerable part of the acreage is cleared, but much of the cleared land is idle. Corn, lespedeza, redtop, beans, and peas are the general farm crops grown, and strawberries the principal truck crop.

FIGURE 6.—*A*, Looking upstream along Piney River toward Spring City and the Cumberland escarpment through the gap in Muddy Creek Ridge. The Sequatchie soils cover many of the low alluvial benches along the streams. Corn occupies a considerable part of this acreage, and lespedeza and small grains are common crops *B*, Areas represented by the Clarksville-Fullerton soil association are characterized by light-colored surface soils and a rolling to hilly relief. A mixed pattern of crops, unimproved pasture, idle land, and forest occupy these soils. View 2 miles southeast of Dayton. *C*, Many of the more productive farms in the valley below the Cumberland escarpment are well equipped and have substantial and well-kept farm buildings. Part of the land of this farm 5½ miles northeast of Spring City, is on the cherty ridge land (Clarksville-Fullerton soil association) to the rear of the buildings, but much of the cropland is in the valley (Talbott-Allen-Lindside soil association).

TALBOTT-COLBERT-WAYNESBORO

The Talbott-Colbert-Waynesboro soil association (7 on the map) lies as an irregular broad valley directly southeast of and parallel

to the Clarksville-Fullerton soil association (fig. 7), and a smaller area lies within the general area of that association. The soils for the most part are developed from argillaceous limestone of the Chickamauga formation, but an appreciable area has been developed from old general alluvium, composed of material washed chiefly from soils overlying limestone and shale of the Valley and Ridge province, metamorphosed rock of the Blue Ridge province, and sandstones of the Appalachian Plateaus. The relief is chiefly undulating to rolling, and the average approximates that of the Talbott-Allen-Lindside association. Surface drainage is fairly well developed and is sufficient for most areas. Internal drainage is fair to good in some of the soils but is poor to fair in the more clayey types. The depth to bedrock has a wide range, and rock outcrops characterize an appreciable acreage. Most of the land of this association has been cleared for the production of crops and pasture. The less well-drained and stony areas for the most part are productive of pasture plants, and much of the acreage suitable for tillage is used for corn, red clover, timothy, small grain, and other general farm crops.

MUSKINGUM-APISON

The Muskingum-Apison soil association (8 on the map) lies as irregular broken steep ridges. The largest area lies east and northeast of Spring City and is cut by the valleys of White Creek and the Piney River. The four other areas, in the southeastern part of the county, lie as a chain severely broken by the meanders of the Tennessee River. The underlying rock is of the Rome formation. In general, the depth to bedrock is shallow, and the soils are of low productivity, difficult workability, and when cultivated present serious problems of conservation. Much of the acreage is in forests, a use to which most of this land is best suited.

CONASAUGA

The Conasauga soil association (9 on the map) is one of the less extensive associations of the county, the largest area lying as a narrow strip about 2 miles south of Spring City. The relief is undulating to rolling. The underlying rock is of the Conasauga formation, and the average elevation is about 780 feet. The surface drainage is sufficient, but internal drainage for the most part is slow. Much of the acreage has been cleared, but a large part of the land is idle. The Conasauga soils, which predominate, are of low fertility and when cultivated present difficult problems of conservation. They are not well suited to intensive agricultural use.

HUNTINGTON-WOLFTEVER-SEQUATCHIE

The Huntington-Wolftever-Sequatchie soil association (10 on the map) occupies irregular and comparatively narrow strips of bottom land along the Tennessee River. Surface drainage is not well developed, but the internal drainage is generally fair to good. The relief is mostly nearly level to gently undulating, and practically all the acreage is of fair to high fertility. A considerable part of this association has been inundated by the Chickamauga and Watts Bar Reservoirs and most of the rest has been cleared and is used to a great extent for the production of row crops, chiefly corn.

FIGURE 7.—A large part of the acreage represented by the Talbott-Colbert-Waynesboro soil associatio
erately fertile, and almost entirely cleared; the partly cleared strongly rolling hills in the n
Fullerton soil association; and the forested mountain slope in the far background is represent
land soil association.

DESCRIPTIONS OF SOIL UNITS

The soils of Rhea County are classified in 14 groups, expressed on the soil map by distinguishing color hues, according to topographic position and parent rock, as follows: (1) The uplands, (2) colluvial lands, (3) terraces, and (4) bottom lands. The soils of the first seven groups are on the uplands and these represent six distinct kinds of parent rock. The first two groups have the same kind of parent rock and are distinguished by differences in slope. The soils of groups 8 and 9 are on colluvial slopes and these are distinguished by differences in parent rock. The soils of groups 10 and 11 are on stream terraces and are distinguished by the dominant parent rocks. The soils of groups 12 and 13 are on the bottom lands and are distinguished by the dominant rocks from which the material was derived. Group 14 is comprised of miscellaneous land types, chiefly of the uplands.

In the following pages the soil types and phases are described in detail and their agricultural relations are discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are given in table 5.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Rhea County, Tenn.*

Type of soil [1]	Acres	Percent
Abernathy silt loam	960	0 4
Allen stony fine sandy loam, eroded phase	192	1
Allen very fine sandy loam	448	2
Eroded sloping phase	1,024	5
Apison very fine sandy loam	256	1
Eroded phase	192	.1
Eroded rolling phase	1,664	8
Severely eroded rolling phase	128	1
Atkins silt loam	384	2
Atkins very fine sandy loam	1,408	7
Burgin clay loam	448	2
Clarksville cherty silt loam	4,672	2 2
Eroded phase	3,456	1 6
Eroded hilly phase	7,744	3 6
Eroded steep phase	3,008	1 4
Hilly phase	5,184	2 4
Undulating phase	512	2
Colbert silt loam	1,728	.8
Deep phase	960	.4
Colbert silty clay loam		
Eroded phase	832	4
Eroded rolling phase	768	4
Conasauga silt loam	896	.4
Conasauga silty clay loam.		
Eroded phase	896	4
Severely eroded phase	960	.4
Crossville loam	320	1
Rolling phase	512	2
Cumberland gravelly fine sandy loam	192	1
Eroded hill phase	576	.3
Eroded sloping phase	768	.4
Cumberland silty clay loam:		
Eroded phase	384	2
Eroded sloping phase	768	.4
Severely eroded sloping phase	896	4
Dewey silt loam	128	.1
Dewey silty clay loam		
Eroded phase	1,344	.6
Eroded hilly phase	896	.4
Eroded undulating phase	576	3
Severely eroded hilly phase	128	1
Dunning silty clay loam	960	4
Egam silty clay loam	576	0 3
Emory silt loam	576	3
Sloping phase	512	2
Etowah silt loam	64	(2)
Etowah silty clay loam:		
Eroded phase	1,152	5
Eroded sloping phase	640	2
Fullerton cherty silt loam	2,368	1 1
Eroded phase	3,712	1 7
Eroded hilly phase	4,544	2 1
Eroded steep phase	1,984	.9
Hilly phase	2,624	1 2
Severely eroded phase	128	.1
Severely eroded hilly phase	704	.3
Undulating phase	512	.2
Fullerton silt loam	320	1
Greendale cherty silt loam	1,472	7
Greendale silt loam	2,560	1 2
Guthrie silt loam	1,088	5
Hanceville fine sandy loam	192	1
Hartsells fine sandy loam	4,224	2 0
Eroded rolling phase	1,984	9
Rolling phase	16,708	7 8
Hector fine sandy loam		
Eroded phase	640	3
Hector stony fine sandy loam	1,408	7
Holston gravelly fine sandy loam	576	3
Holston very fine sandy loam	640	3
Huntington fine sandy loam	960	4
Huntington silt loam	1,024	5
Jefferson stony fine sandy loam	192	1
Eroded sloping phase	576	3
Jefferson very fine sandy loam	1,408	.7
Eroded sloping phase	1,152	5
Limestone outcrop	768	.4
Lindside silt loam	1,408	.7
Lindside silty clay loam	512	.2
Melvin silt loam	1,600	7
Mines, pits, and dumps	128	1
Montevallo silt loam		
Hilly phase	768	4
Muskingum stony fine sandy loam	11,328	5 3
Eroded hilly phase	1,984	9
Hilly phase	31,104	14 5
Rolling phase	11,200	5 2

[1] Where data are given for phases only the normal type is not mapped in the county.
[2] Less than 0.1 percent.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Rhea County, Tenn.*—Continued

Type of soil	Acres	Percent
Nolichucky fine sandy loam	128	0 1
Eroded sloping phase	448	2
Ooltewah fine sandy loam	64	(2)
Ooltewah silt loam	1,600	7
Philo fine sandy loam	2,308	1 1
Philo silt loam	384	2
Pope fine sandy loam	1,088	5
Pope loamy fine sand	320	1
Pope silt loam	640	3
Roane gravelly silt loam	3,200	1 5
Roane silt loam	640	3
Robertsville silt loam	128	1
Rolling stony land, (Colbert soil material)	2,304	1 1
Rough gullied land		
Apison and Conasauga soil materials	1,088	5
Limestone residuum	832	4
Rough stony land (Muskingum soil material)	17,920	8 3
Sequatchie fine sandy loam	2,176	1 0
Sequatchie loamy fine sand	1,408	7
Staser loamy fine sand	448	2
Stony colluvium, (Muskingum soil material)	1,664	0 8
Taft silt loam	1,088	5
Talbott silt loam	832	4
Talbott silty clay loam		
Eroded phase	1,408	7
Upshur silt loam	192	1
Hilly phase	448	2
Upshur silty clay loam		
Eroded phase	896	4
Eroded hilly phase	1,472	7
Waynesboro fine sandy loam	320	1
Eroded sloping phase	640	.3
Waynesboro gravelly fine sandy loam	128	1
Eroded hilly phase	512	2
Eroded sloping phase	768	4
Wolftever silt loam	1,472	7
Wolftever silty clay loam		
Eroded sloping phase	128	1
Total	214,400	100 0

Abernathy silt loam.—This is the brown or reddish-brown friable fertile soil occurring in closed saucerlike depressions and associated chiefly with Dewey, Cumberland, and Etowah soils. It is composed chiefly of material washed from the immediately surrounding areas of more productive soils developed from material derived chiefly from limestone. Although this soil has little or no surface drainage, subterranean drainage through crevices in the limestone is sufficient to remove excess moisture; however, temporary flooding may follow the heavier rains.

The soil is variable and no distinct layers have developed. In most places the 12- to 18-inch brown or reddish-brown mellow silt loam surface soil is underlain by somewhat lighter brown heavy silt loam. Generally a very dark layer several inches thick is at a depth of about 30 inches and probably represents the original surface soil previous to accelerated erosion that resulted after tillage of the surrounding upland. Below a depth of 3 feet the material is generally mottled gray, yellow, and brown silty clay. A few areas having a more sandy texture are included in this silt loam type.

This silt loam is very fertile, and its position and physical character are such that it is easily worked and its conservation requirements are not exacting. Most of the areas are continually receiving highly fertile materials from the surrounding soils and some benefit from seepage waters. There are a few areas, however, that receive wash from deep subsoil exposures or gravelly materials and are therefore injured as cropland.

The aggregate area is 960 acres, mostly in the vicinity of Washington. All the areas are small, but on many farms on which most of the soils are of moderate to low fertility a small acreage of this soil is of considerable importance.

Continuous row cropping, especially to corn, is the common practice. Average yields range from 45 to 50 bushels an acre on the more fertile areas and compare favorably with those obtained on

Huntington silt loam. The lower yields are obtained where the recent wash is from areas of exposed subsoil material. It is a productive soil for pasture and is of special value as such because of its comparatively favorable moisture relations late in summer (fig. 8, *A*). It is not exacting in its management requirements, and as a consequence very little fertilization or water-control practices are necessary.

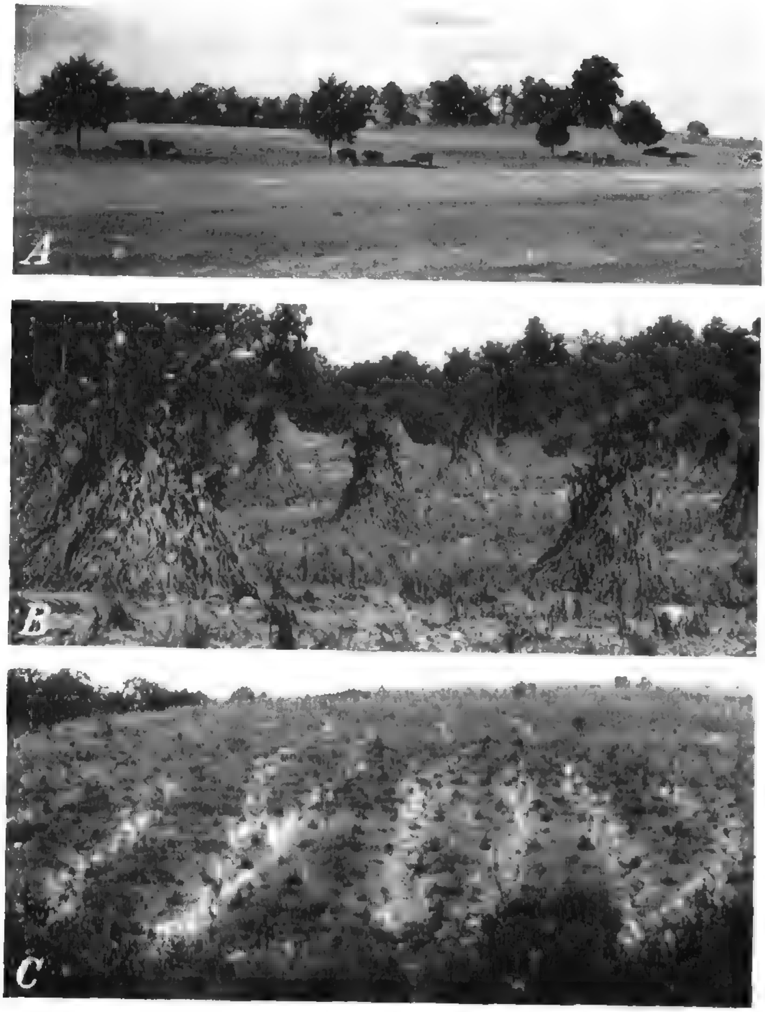

FIGURE 8.—*A*, The smoother areas of the more fertile soils developed over limestone are very desirable for crops, including pasture. View near Carp School south of Spring City of a well-managed area of Abernathy silt loam (foreground) and Cumberland silty clay loam, eroded sloping phase (background). *B*, An exceptionally good crop of sorghum cane on Clarksville cherty silt loam 3 miles south of Dayton. Mixed redtop, orchard grass, and lespedeza hay were grown on this field the two previous years, and 200 pounds an acre of 45-percent phosphate fertilizer had been applied to the second-year hay crop. *C*, A 1½-year old stand of shortleaf pine on an area of Clarksville cherty silt loam, eroded steep phase. Destruction by gullying took place after the pines were planted.

Allen stony fine sandy loam, eroded phase.[8]—This soil differs from Allen very fine sandy loam chiefly in that it has steeper slopes, is materially eroded, and has a sufficient quantity of stone in it to interfere with tillage or practically to prohibit field operations. The slopes range from 5 to 12 percent.

The total acreage of this soil is 192, and most of it lies on the foot slopes adjacent to the Cumberland escarpment. Internal drainage is good, but external drainage is excessive.

A considerable part has been cleared and cropped, but some of this now lies idle. Corn, lespedeza, and small grains are the principal crops grown, and the average yields are relatively low. The soil is fairly well suited to pasture but poorly suited to crops that require tillage. Under natural conditions its carrying capacity as pasture land is not high, but with proper fertilization and choice of pasture plants it is capable of supporting a good grass cover. Shortleaf and loblolly pines do well on this soil, and the most severely eroded areas could be planted to this type of forest.

Allen very fine sandy loam.—This is a well-drained friable reddish-colored soil developed from colluvial-alluvial material washed chiefly from the Hector, Hanceville, and Muskingum soils. The areas lie mainly on foot slopes of the Cumberland escarpment, and most of the acreage is along the northwestern border of the Talbott-Allen-Lindside soil association. The aggregate area is 448 acres.

In cultivated areas the 8-inch surface layer ranges from yellowish-brown to brownish-gray very fine sandy loam to fine sandy loam. Below this layer the material is more reddish and grades into friable sandy clay loam. Subsoil material of firm but friable yellowish-red sandy clay is at a depth of 16 inches. Below a depth of about 34 inches is variegated or mottled red, yellow, brown, and gray sandy clay that is more friable than the layer above. A few sandstone fragments or cobbles are on the surface and throughout the soil mass but are not sufficiently abundant to interfere with tillage, although the partly disintegrated sandstone and shale fragments are more abundant in this lower layer.

The relief is undulating, the gradient ranging from 2 to 5 percent. Both surface and internal drainage are good. This soil is of moderate fertility, is easily worked, and is suited to a wide variety of crops commonly grown. Its proper conservation, however, requires attention to maintain its fertility, and the control of runoff is necessary.

Practically all of this soil is tilled, and a great variety of crops are grown on it. Corn under normal conditions and the more common level of management yields 25 to 30 bushels an acre, wheat 8 to 12 bushels, lespedeza hay 1 to 1½ tons, alfalfa 2 to 2½ tons, and strawberries 50 crates of 24 quarts each. Other common hay crops do well also. Most crops respond to phosphorus, and lime is essential for alfalfa.

Allen very fine sandy loam, eroded sloping phase.—This soil differs from the normal type chiefly in having a more rolling surface and in having lost 50 to 75 percent of the surface soil by erosion. The slopes range from 5 to 12 percent. Erosion has been sufficient to expose the subsoil in some places, and the plow layer over most of

[8] Normal type not mapped.

the area has some subsoil mixed with it. The aggregate area is 1,024 acres, all of which is associated with other Allen soils or with the Jefferson soils.

The productivity is considerably less than that of Allen very fine sandy loam, chiefly because of the eroded condition and stronger slope. The problem of conservation is difficult also, because of the slope and undesirable physical character of the eroded parts. All of the acreage has been cultivated at some time, and most of it is being used for crops now, although a part of it is idle. This soil is used for most general farm crops, fig. 16, *C*. Proper management practice requires moderately heavy applications of fertilizers, long rotations, and particular care in controlling runoff.

Apison very fine sandy loam.—This soil occupies gentle slopes associated with the shale ridges of the Valley and Ridge part of Rhea County, and with the Muskingum, Montevallo, Upshur, and Conasauga soils. It is a brownish-yellow soil developed from material derived from thin-bedded acid shales and fine-grained sandstones. The 4- to 6-inch surface layer in cultivated areas is yellowish-gray mellow very fine sandy loam. Below this and to a depth of about 20 inches is yellowish-brown friable sandy clay that is somewhat compact and hard when dry. Below this layer is mottled or variegated yellowish-brown, yellow, and reddish-brown friable sandy clay loam. Bedrock of sandy shale lies at a depth of about 30 inches. Small soft shale fragments occur throughout a great part of the soil mass, especially in the subsoil.

The relief is undulating to gently rolling, the gradient seldom exceeding 5 percent. Both surface and internal drainage are good. During rainy seasons the soil becomes moderately sticky but dries out rapidly.

The aggregate area of this soil is 256 acres, and the most extensive areas are near Friendship Church in the northeastern part of the county. About 60 percent of it is cleared and used for the production of crops. General farm crops, especially corn, small grain, lespedeza hay, and certain truck crops, including strawberries and tomatoes, are grown. Yields are rather low. Under average conditions and common management practices, corn yields 20 to 25 bushels to the acre, wheat 8 to 10 bushels, oats 15 to 20 bushels, rye 12 to 15 bushels, strawberries 30 to 40 crates of 24 quarts, and mixed hay ½ to 1¼ tons. Appreciable quantities of fertilizer are used for tomatoes, and strawberries are grown mostly on newly cleared ground.

Its natural productivity is low, and although fertilizers have not been commonly used, good response can be expected, especially from nitrogen, phosphorus, and lime. Experience in other sections indicates that good yields of alfalfa as well as other common field crops can be obtained with proper management including applications of manure, lime, and phosphate. Workability of this soil is good, and the problem of conservation of the soil material under good management is not particularly difficult. Erosion, however, is a serious hazard under management practices that do not maintain a good protective vegetative cover. A large part of this soil has been severely damaged by erosion in the past because of the failure to maintain this protection. This hazard is of particular significance because of their relatively shallow depth to bedrock.

Apison very fine sandy loam, eroded phase.—Most of this soil has lost more than half of its surface as a result of erosion, leaving the subsoil exposed in places. This phase consists of areas of the typical soil that have either been cultivated for a considerable length of time or have not been cropped under a system of good management. The 192 acres mapped is associated with the normal type. All of the acreage has been cleared, and much of it is being cultivated, although some lies idle at times because of its poverty and poor physical condition. Its productivity is somewhat lower and its workability a little less desirable than on the normal type. Particular care should be given to the control of erosion, and if a good state of fertility is to be established special attention must be given to fertilization and to selection of crops. Longer rotations with legumes and close-growing crops, as small-grain and hay crops, should be used as much of the time as feasible.

Apison very fine sandy loam, eroded rolling phase.—This soil has a rolling surface and has lost much of its surface layer by erosion. It generally lies on long slopes extending out from the base of the shale and sandstone ridges of the Valley and Ridge province. Included with this soil are a few areas having a silt loam surface layer. These areas correspond to Montevallo silt loam as mapped in other parts of the Valley and Ridge province, but because of the limited acreage and similarity from the standpoint of agricultural use to the Apison type it has been included with this latter soil.

The relief is rolling, and the slope ranges from 5 to 12 percent. Internal drainage is good, but external drainage is excessive.

The aggregate area is 1,664 acres. The larger areas are north of Cotton Port Ferry and near Friendship Church in the northeastern part of the county. The profile is similar to the typical soil, but the surface layer is thinner and the subsoil is exposed in places. The natural productivity is low, and because of the difficulty of building up and maintaining fertility and controlling runoff, its proper conservation is moderately difficult under a system of management comprised chiefly of crops that require tillage. Because of these conditions, the frequency of tillage should be held at a minimum. With proper fertilization and choice of pasture crops, this soil is capable of affording fairly good grazing; without fertilization, the quality of the vegetation is poor, the yield is light, and the carrying capacity as pasture land is low.

Apison very fine sandy loam, severely eroded rolling phase.—This soil consists of areas that have lost practically all of their original surface soil and in some places part of the subsoil, therefore, the plow layer is composed for the most part of subsoil material. The relief is rolling, and the average gradient ranges from 5 to 12 percent. Runoff is excessive, but internal drainage is good.

The aggregate area is 128 acres, and most of it lies in small tracts southwest of Watts Bar Dam. All the acreage has been cropped at some time, but much of it, because of its inability to produce appreciable yields of crops under present practices, is now idle. Some of these areas are covered by shortleaf pine, others by a brushy growth of sassafras, persimmon, and briers.

The low productivity and the problem of conservation make this soil poorly suited to crops that require tillage. Pastures are difficult

to establish and maintain. Unless particular attention is given to management this soil probably can best be used as forest land.

Atkins silt loam.—This very poorly drained acid soil of the first bottoms is comprised chiefly of material washed from acid shales. It has a finer texture than the fine sandy loam type. The 6-inch surface layer is finely mottled gray and yellow loam or silt loam underlain by bluish-gray mottled with yellow and brown firm to compact clay loam, which generally extends to a depth of several feet, but in places there are sandy layers or laminations. Variations in texture and degree of drainage are common, and in places, pieces of sandstone cobbles or fragments are abundant.

Some of the larger areas of the 384 acres mapped are in the vicinity of Ogden Church, along the railroad near Roddy, and about 1 mile north of Kiuka School. All these areas are nearly level, poorly drained, and subject to overflow. About half of the acreage is cleared, but only a small part is cropped. Chiefly because of its poor drainage, this soil is poorly suited to tillage and to the production of most general farm crops. Because of the moisture relations, it is particularly useful as pasture during the drier season of the year, although the common pasture plants are not particularly desirable. The quality of the vegetation, however, can be improved greatly by proper seeding and management.

Atkins very fine sandy loam.—This very poorly drained acid soil of the first bottoms is composed of materials washed largely from soils underlain by acid shales and sandstones. It is associated with the Pope and Philo soils, which are well-drained and imperfectly drained soils, respectively, of the first bottoms.

To a depth of about 6 inches the surface soil is lightly mottled gray, dark-gray, and yellow friable fine sandy loam or very fine sandy loam. Below this and to a depth of about 16 inches is mottled gray, yellow, and brown friable very fine sandy loam. The underlying material is likewise mottled but grades into a finer texture, which generally is sandy clay. The entire profile is strongly acid.

The aggregate area of 1,408 acres lies on the first bottoms along creeks and drainageways, especially in the Cumberland Plateau part of the county. Some of the larger areas are in the vicinity of Ogden Church, west of Bogles Chapel, and about 1 mile northeast of Spring City along the railroad. The surface is nearly level, and most of the acreage is subject to periodic flooding.

Probably half of this soil has been cleared, but chiefly because of its poor drainage, only a small part is suitable for crops. It is suited to pasture, and its moisture relations make it particularly useful for this purpose during the drier season of the year. It is of particular value as pasture land on the Cumberland Plateau, inasmuch as most of the soils of this part of the county are not well suited to pasture, especially during the drier part of the summer. Areas that are properly drained can be expected to produce good yields of corn, sorghum, lespedeza, and redtop. The practicability of drainage, however, must take into consideration its cost and relative advantage.

Burgin clay loam.—This dark-colored soil on colluvial-alluvial deposits has been washed chiefly from soils of the Colbert series. The 10-inch surface layer is dark-brown plastic silty clay loam or silty

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clay. Below this is yellowish-brown slightly mottled with brown and gray heavy plastic clay. From a depth of 20 to 32 inches it is mottled brown, yellow, and gray plastic clay that becomes very hard when dry. Bedrock limestone commonly lies at a depth of 2 to 5 feet. The reaction of the soil material is generally neutral to slightly alkaline.

The relief is very gently sloping to nearly flat. Surface drainage is slow but adequate for most crops, and internal drainage is slow. In wet seasons water from the adjoining high ground generally collects on it, causing the soil to be excessively wet for extended periods.

A great part of the 448 acres is south of the village of Washington. Probably half of the acreage is cleared. Corn, some small grain, and hay are grown on a small part, but pasture occupies the greater part of the cleared land. This is a fertile soil, but because of its poor drainage and unfavorable consistence its suitability for crops is limited. Corn generally yields about 10 to 15 bushels and lespedeza hay about three-fourths ton to the acre, but under good management practices and artificial drainage, corn yields as much as 40 bushels an acre. This crop is especially uncertain because of unfavorable moisture relations. Workability of the land for crops that require tillage is often difficult. Indications are that with proper drainage and fertilization, good pasture and hay crops can be grown. Because of the relatively moist condition many areas are particularly useful as pasture land during the dry midsummer season.

Clarksville cherty silt loam.—The Clarksville soils are developed from material derived from very cherty dolomitic limestone. They are characterized by a gray cherty surface soil and a yellow subsoil, which are locally referred to as white gravelly land. The 8-inch surface soil is light yellowish-gray cherty silt loam. In places the cherty material is so abundant as to interfere materially with field operations. Below this to a depth of about 20 inches is brownish-yellow cherty silt loam that grades with depth to cherty silty clay loam. This material is friable under average moisture conditions but is firm to moderately compact when dry. Beneath this layer is mottled reddish-brown, yellow, and gray cherty silty clay loam grading into cherty silty clay below a depth of about 30 inches. The mottling is more intense with depth. Bedrock of cherty dolomitic limestone is at a depth of 10 to 30 feet or more.

The relief is rolling, ranging from approximately 5 to 12 percent. Both surface and internal drainage are good. The Clarksville soils are more open, and as a consequence, absorb moisture more rapidly than the Dewey soils.

The aggregate area of 4,672 acres is associated with the Fullerton soils and is widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. There is a very small acreage, however, in the Jefferson-Clarksville-Upshur soil association. A considerable part of this soil has been cleared, and much of it is used for crops, but an appreciable acreage lies idle and has grown to a cover of sassafras, persimmon, broomsedge, and briers. A small area is occupied by hardwood forest.

This soil is of low productivity. Heavy applications of fertilizers, especially of phosphorus and lime, are necessary if good yields of farm crops are to be obtained. The soil has good workability, however, and can be tilled throughout a wide range of moisture conditions.

The problem of maintaining a high state of fertility is considerable, but the problem of controlling runoff is not serious, as the soil absorbs moisture readily.

The crops grown are similar to those produced on the Fullerton soils. Corn and wheat are the principal grains, and lespedeza and redtop are the chief hay crops. Truck crops, chiefly strawberries and tomatoes, cover a rather large acreage. Crop yields under the more common level of management, which includes very little fertilization, are relatively low. Corn, under common management, which may include small irregular applications of fertilizer, yields 12 to 18 bushels to the acre, wheat 6 to 10 bushels, and rye 8 to 10 bushels. Hay, which for the most part is mixed lespedeza and redtop, yields under average conditions about half a ton to the acre. A small acreage of kudzu produces a luxuriant cover even where not fertilized. A small acreage of sorghums is also grown (fig. 8, *B*). Strawberries are commonly grown on newly broken land and yield from thirty to forty 24-quart crates an acre during favorable seasons, and tomatoes yield well under good management. It is a common practice to clear new ground on Clarksville soils for strawberries and to abandon these areas after two or three seasons. Poor yields are obtained on such tracts for this short period under the management practiced, and if satisfactory yields are to be maintained an improved management will be required.

Clarksville cherty silt loam, eroded phase.—This soil has lost approximately 50 percent of its original surface layer. As a result, the subsoil is exposed in places, and on much of the area the plow layer includes some subsoil material. There are small gullies, and in a very few places deep gullies are along the drainageways. This phase consists of Clarksville cherty silt loam that has been under cultivation for many years. Accordingly, all the 3,456 acres has been cropped at some time but at present an appreciable part lies idle and is covered by a variable growth of sassafras, persimmon, broomsedge, and briers. The abandoned areas have only a scattered cover of these plants, which are not a desirable type, and afford little grazing. Areas that are farmed are used for approximately the same crops as are areas of the normal type, but their productivity is lower, their workability is more difficult, and the control of runoff is greater. Results on the soil in communities adjacent to Rhea County indicate that response to heavy applications of phosphate, lime, and manure for such crops as alfalfa can be expected, although yields are much less than those on the more productive soils.

Included with this soil is a small acreage of Clarksville cherty silt loam, severely eroded phase, which has lost all or nearly all of its original surface soil. The plow layer, therefore, is composed almost entirely of subsoil material and is very cherty. The texture is more nearly a cherty clay loam.

Clarksville cherty silt loam, eroded hilly phase.—This soil has a hilly surface and has lost at least half of its surface soil as a result of erosion. A small acreage has been severely eroded, and in such areas practically all of the surface soil has been lost and they are characterized by a few small gullies and in some places by occasional fairly deep ones. The aggregate area of 7,444 acres is widely distributed throughout that part of the county represented by the Fuller-

ton-Clarksville soil association. There is also a small acreage in that part of the county represented by the Jefferson-Clarksville-Upshur soil association. All this soil has been cropped at some time, but a great part of it is now idle and covered with sassafras, persimmon, briers, and other brushy growth. Like the other Clarksville soils, it is of low natural fertility, and because of its eroded condition and hilly relief is rather difficult to work and is more cherty than the normal type.

This soil is not well suited to the production of crops that require tillage. In its present condition it is difficult to build up and maintain in a high state of fertility and erosion is difficult to control. With proper fertilization and seeding, however, this soil is fairly well suited to pasture crops and possibly to some close-growing small grain and hay crops. The most severely eroded parts may well be planted to shortleaf and loblolly pine.

Clarksville cherty silt loam, eroded steep phase.—This steep phase has lost at least half of the surface soil by erosion. The slope averages 30 percent or more, and most of the acreage is considerably more cherty than the smoother Clarksville soils, and in part of the acreage that is severely eroded practically all of the surface soil has been lost and occasional small gullies have formed.

Most of the aggregate area of 3,008 acres is associated with hilly and steep phases of the Clarksville and Fullerton soils. The areas are widely distributed throughout the Fullerton-Clarksville soil association, and a limited acreage is in the Jefferson-Clarksville-Upshur soil association. All this soil has been cleared and cropped at some time, but a large part of it is now idle and covered with broomsedge and weeds and such brushy growth as sassafras, persimmon, and briers. This soil has a low productivity, is difficult to work, and when tilled frequently presents a problem in conservation mainly because of the inability to control the water. The carrying capacity of naturally established pasture on idle areas is low because of the small yield and poor quality herbage. With proper fertilization and seeding, however, fair to good pasture and meadow can be maintained on the less steep parts. The most severely eroded areas are most difficult to improve and may be best utilized as forest land. Stands of loblolly and shortleaf pine have been established successfully by planting on some severely eroded areas (fig. 8, *C*).

Clarksville cherty silt loam, hilly phase.—The aggregate area of 5,184 acres has a hilly relief with a slope of 12 to 25 percent. This soil is widely distributed over that part represented by the Fullerton-Clarksville soil association, and a small acreage is included in the Jefferson-Clarksville-Upshur. Most of this soil is still in forest, although a small part has been cleared recently and is used for crops. The forest cover is comprised chiefly of oak, hickory, maple, sweetgum, and dogwood. Its best use is for pasture, but its carrying capacity is low unless proper fertilization and seeding are practiced. It is probably better to leave this land in forest, unless badly needed for grazing land. Chiefly because of its low natural fertility and strong slopes, it is not well suited to crops that require tillage. If crops are grown, they should be confined, as far as possible, to close-growing grains and hay crops. A small acreage is occasionally cleared and used for strawberries for 2 or 3 years, after which it may again be idle.

Clarksville cherty silt loam, undulating phase.—This soil has a relatively smooth relief with the gradient seldom exceeding 5 percent. The areas are confined to the smooth parts of the ridges. Much of the 512 acres is cleared and used for crop production. Like the other Clarksville soils it is of low fertility but it is somewhat more desirable as agricultural land, because of its smoother surface and consequent easier workability and greater freedom from erosion.

Colbert silt loam.—This imperfectly drained soil is developed from material derived from clayey limestone and is characterized by a yellowish plastic subsoil and a shallow depth to bedrock. The 4- to 8-inch surface soil is brownish-gray to grayish-brown friable silt loam, underlain by mottled yellow and gray plastic silty clay loam to a depth of about 16 inches. When dry, this material is hard and compact. To a depth of 16 to 40 inches is mottled yellow, brown, and gray sticky plastic clay. Bedrock limestone lies at a depth of 15 inches to 4 feet and outcrops at the surface in some places. The outcrops are not numerous enough to interfere seriously with field operations.

The relief is nearly level to gently rolling. Surface drainage is adequate in most places, but internal drainage is very slow. Owing to the plastic clayey nature of the subsoil and the shallow depth to the bedrock, the soil in many places remains wet for extended periods following rains.

The aggregate area of this soil is 1,728 acres. Most of it is in that part represented by the Talbott-Colbert-Waynesboro soil association, and a large part of it is in the vicinity of and east and southeast of Washington. About 75 percent is cleared and used for crops.

Colbert silt loam is moderately low in productivity and its workability is somewhat difficult, owing to the heavy nature of the soil and its slow drainage. It can be tilled satisfactorily only under a relatively narrow range of moisture conditions; when wet the soil mass puddles badly, and when dry it breaks to hard chunks. Although the surface is relatively smooth, the loss from erosion is considerable, especially when row crops are grown. At present corn, wheat, and hay are the principal crops, and a small part of the cleared acreage is used for pasture. Lespedeza and redtop are the chief hay crops, and much of the pasture is native or self-established grasses. Under average conditions and common management practices corn yields 12 to 18 bushels an acre, wheat about 10 bushels, and lespedeza hay about three-fourths of a ton. Small quantities of strawberries and tomatoes are grown as cash crops. Corn and hay receive little fertilization, but strawberries and tomatoes are given at least moderate applications. Wheat is generally fertilized, especially with phosphate. Not much alfalfa or red clover is grown on this soil, but observation and experience in areas adjacent to Rhea County indicate that they can be grown, at least on the better drained parts when properly fertilized and well managed. Land treated with 2⅓ tons of lime and 160 pounds of superphosphate to the acre yields 3 tons of alfalfa; and, where phosphate has been applied, approximately 2 tons of red clover in a favorable year. Grasses do fairly well on this soil, and with proper fertilization and seeding bluegrass and white clover would afford good pasture. Because of the physical character of the Colbert soils, however, pastures may be expected to dry out relatively early during the dry season of late summer and fall.

Colbert silt loam, deep phase.—This phase has a greater depth to bedrock than the typical soil. The 6-inch surface layer is grayish-brown friable silt loam and generally contains some rounded brownish pebbles and lime-rock fragments. Below this and to a depth of about 20 inches is brownish-yellow silty clay loam friable when moderately dry but sticky when wet. The material below this is mottled yellow or yellowish-gray and brown plastic silty clay and contains some small concretions. Bedrock of clayey limestone is at a depth of 4 to 5 feet. There are a few rock outcrops in some places, but they are not sufficiently abundant to interfere materially with the field operations. A few areas in the vicinity of Frazier School are comprised essentially of normal Colbert silt loam over which is a thin layer of alluvial material. The relief is nearly level to gently rolling. Surface drainage is adequate, but internal drainage is poor to fair.

The aggregate area of this soil is 960 acres, and the greater part of it is represented by the Talbott-Colbert-Waynesboro soil association. There are a few areas in the locality northeast of Dayton. About 90 percent has been cleared and is used for general farm crops. It is fairly productive, and because of its better permeability and consistence it is more easily worked and less subject to erosion than the normal type. Corn yields 20 to 30 bushels an acre, wheat 12 to 16 bushels, and lespedeza hay 1 to 1¼ tons. Some alfalfa is grown, and yields range from 2 to 3 tons to the acre. Only a small acreage of strawberries is grown. Crops respond well to fertilization, and legumes, as alfalfa and red clover, require applications of lime and phosphate if good stands are to be obtained.

Colbert silty clay loam, eroded phase.—This soil has lost one-half to three-fourths of the surface layer through erosion. As a result the subsoil is exposed in places, and the plow layer ordinarily consists partly of subsoil material. The relief is undulating to gently rolling. Surface drainage is good to slightly excessive, but internal drainage is slow.

The aggregate area is 832 acres, and most of it is in the vicinity of Frazier School and east of Washington. There are also a few areas represented by the Talbott-Allen-Lindside soil association. All this soil has been cleared and cropped, but parts of it are now used as permanent pasture. Chiefly because of the eroded condition, crop yields are lower than those obtained on Colbert silt loam. Its low productivity, its moderately difficult workability, and the problem of conservation make this soil poorly suited to crops that require tillage, and frequent growing of row crops makes the control of runoff and maintenance of fertility difficult. Hay, close-growing small grains, and especially pasture are better suited to this soil. Alfalfa, when treated with a heavy application of manure, 2⅓ tons of lime, and the equivalent to 550 pounds of 16-percent superphosphate, yields about 3 tons of hay to the acre in a favorable year. With proper seeding and fertilization, including phosphate and lime, it is possible to maintain fairly good pasture. This is difficult, however, in the dry midsummer season because of the tendency of this soil to dry out rapidly.

Colbert silty clay loam, eroded rolling phase.—This soil has lost one-half to three-fourths of its surface by erosion. Surface drain-

age is better than on the smoother Colbert soils, but the problem of controlling the water on the land is greater.

The total of 768 acres is associated with other members of the Colbert series. It is characterized by relatively low productivity, poor workability, and a difficult problem of conservation. For these reasons it is considered poorly suited physically to crops that require tillage. It is capable of affording good pasture when properly fertilized and seeded. Like the other Colbert soils, however, it is probably not capable of supporting good grazing throughout the dry midsummer season because of its relatively narrow range of moisture conditions suitable for plant growth.

Conasauga silt loam.—The Conasauga soils resemble those of the Colbert series except that they have developed from material derived from calcareous shale rather than from limestone. The 6-inch surface soil of Conasauga silt loam is yellowish-gray to grayish-brown mellow silt loam, underlain by yellow to grayish-yellow friable loam to a depth of 12 inches. Below this depth the material grades into brownish-yellow plastic silty clay loam, which is mottled dull-yellow and gray plastic silty clay or clay at a depth of 24 inches. The material of this lower layer contains numerous soft shale fragments that become more abundant and harder with depth. Bedrock of interbedded calcareous shale and limestone, which for the most part is of the Conasauga geologic formation, is at a depth of 20 to 36 inches.

The relief is very gently undulating to gently rolling, the gradient seldom exceeding 5 percent. Surface drainage is adequate, but internal drainage is very slow.

The total area of 896 acres lies in a belt extending southwest from Piney River to about 2 miles southwest of Wolf Creek School. A part of this soil is cleared, and corn, small grains, and certain hay crops are the principal crops grown. Corn yields 12 to 18 bushels an acre, wheat about 10 bushels, oats 15 to 25 bushels, and rye 8 to 12 bushels. Mixed lespedeza and redtop is the principal hay crop, and yields under average conditions range from ½ to 1 ton to the acre. The natural productivity of this soil is only fair, and because of its relatively heavy consistence its workability is moderately difficult. Fertilizers have not been used extensively and a great deal is not known about the results to be expected. Observation and experience, however, indicate, that all legume crops as alfalfa and red clover require at least moderate applications of lime and phosphate. Generally long rotations should be used on this soil, chiefly because of its low productivity and susceptibility to erosion.

Conasauga silty clay loam, eroded phase.—This soil has lost more than half of its surface by erosion. The subsoil is exposed in places, and the plow layer of practically all of it includes some subsoil material. The rolling relief has a slope of 5 to 12 percent. Surface drainage is excessive, and internal drainage is slow.

A large part of the 896 acres mapped is in the vicinity of and northeast of Wolf Creek School. All has been cleared and cropped at some time, but part of it is now lying idle. Corn, small grains, and certain hay crops are the principal crops. Because of the eroded condition, yields average lower and the difficulty of working the land is greater because of the more sloping surface and the heavy consistence of the plow layer than on Conasauga silt loam. The loss by erosion is very

great. For the above reasons this soil is poorly suited to crops that require tillage. With proper seeding and fertilization, including especially phosphate and lime, fairly good pastures can be maintained. Yields of 2 to 3 tons of alfalfa an acre have been obtained in the vicinity of Rhea County where the ground has been properly prepared and 2 tons of lime and the equivalent of about 200 pounds of 43-percent superphosphate applied. It is difficult, however, to maintain good pasture throughout the dry midsummer season because of the tendency of this soil to dry out rapidly.

Conasauga silty clay loam, severely eroded phase.—This phase has a rolling relief and has lost practically all of its surface layer and in some places part of its subsoil layer. In some places the surface is characterized by numerous small gullies and soft shale bedrock outcrops. Surface drainage is excessive, and internal drainage is slow.

The aggregate area of 960 acres lies principally in small tracts, and most of it is in the vicinity of Wolf Creek School and northeastward to Piney River. All of it has been cleared and cropped at some time, but most of it is either idle or used for pasture. A large part of it is best suited to forest. It is of very low productivity, is difficult to work, and when tilled is subject to erosion; therefore, it is poorly suited to crops that require tillage.

Crossville loam.—The Crossville soils are brown loams developed over sandstone and shale and are closely associated with the Hartsells soils on the Cumberland Plateau. They differ from the Hartsells soils chiefly in having a browner color and a somewhat slower internal drainage. The surface soil, which is about 6 inches thick, is grayish-brown fine sandy loam or loam. Below this to a depth of about 12 inches is brown friable loam a little heavier in consistence than the surface layer. From a depth of 12 to 18 inches the material grades into yellowish-brown friable loam and below this depth is mottled yellow and red friable sandy clay. Bedrock of sandstone is at a depth of 26 to 30 inches.

The relief is undulating, the slope seldom exceeding 5 percent. Surface drainage is good, but internal drainage is only fair. The aggregate area is 320 acres. The individual areas are relatively small and are widely scattered over the smoother parts of the Cumberland Plateau.

Although a part of this soil is cleared and cropped, a considerable acreage is covered by hardwood forest, the dominant trees of which are oaks. Corn, hay, small grains, and certain truck crops are the principal crops grown. Lespedeza, redtop, and soybeans are generally grown for hay. The yields of these crops are approximately the same as those obtained on Hartsells fine sandy loam.

Some fertilization is practiced, especially on the truck crops and corn, and an irregular rotation of crops is followed. Response to phosphorus may be expected from most crops, and such legumes as red clover and alfalfa require lime and phosphate. Most crops will respond to potash also.

Crossville loam, rolling phase.—The surface layer is slightly thinner, the depth to bedrock is more variable and less than that of the normal type, and the color is generally a little lighter. The

gradient ranges from 5 to 9 percent. The aggregate area of 512 acres occurs in small, widely scattered areas associated with Crossville loam and the Hartsells soils.

Surface drainage, especially on the more sloping parts, is fairly rapid, but internal drainage is moderately slow. Only a part of the acreage is cleared and cropped. It is used for and suited to the same crops as the typical soil, but yields are a little lower and the problem of conservation a little greater. Because of its shallow depth to bedrock, special care should be taken to minimize erosion.

Cumberland gravelly fine sandy loam.—The 4- to 6-inch surface layer is brown to reddish-brown gravelly fine sandy loam. Below this and extending to a depth of about 22 inches is light reddish-brown firm but friable fine sandy loam grading into sandy clay. The underlying material is red firm but moderately friable sandy clay or silty clay grading at a depth of about 4 feet to variegated yellowish-red, yellow, and brown silty clay. Generally a variable quantity of gravelstones and cobbles, 1 to 5 inches in diameter, are present throughout the entire soil mass.

The relief is undulating, the gradient seldom exceeding 5 percent. Most of the areas are on the highest terraces. Both surface and internal drainage are good. The total area of this soil is 192 acres. Most of the areas are associated with those of other Cumberland soils and soils of the Waynesboro series. An area is southeast of Euchee School.

A large part of this soil has been cleared and is being cropped. General farm crops including corn, small grains, hay, and some truck crops, especially strawberries and tomatoes, are grown. Crops are generally rotated but not according to a fixed plan. Row crops are grown at relatively short intervals and some fertilization is practiced, especially for the truck crops. The yields are similar to those obtained on Allen very fine sandy loam.

This soil is of moderately high natural productivity and presents no particularly difficult problem of conservation. Its workability is impaired somewhat by gravel, especially where it is abundant. The sandy nature of the surface soil and upper subsoil augments percolation of moisture and facilitates tillage. Good response to proper fertilization can be expected, and such crops as alfalfa require lime and phosphate to establish a good stand in areas that have been cropped for sometime without this treatment.

Cumberland gravelly fine sandy loam, eroded hill phase.—The strongly sloping relief of this soil has lost from 50 to 75 percent of the original surface soil as a result of erosion. The subsoil is exposed on much of the steeper parts, and the plow layer on practically all of the acreage is comprised in part of subsoil material. Gullies are common in some places, and these are indicated on the soil map by appropriate symbols. The gradients range from 12 to 25 or 30 percent, and the surface drainage consequently is decidedly excessive. Internal drainage is good. The aggregate area is 576 acres. The larger areas are south and southeast of Euchee School, northwest of Watts Bar Dam, and near Eaves Ferry. Practically all of it is on the steeper parts of high terraces.

All this soil has been cleared and cropped at some time, but now a great part either is idle and is occupied by a brushy growth of sassa-

fras, persimmon, broomsedge, and briers or is used for pasture. The limited acreage now tilled is used for general farm crops.

When first cleared, this soil was fairly productive and was planted to most of the crops common to the section, including strawberries. Chiefly as a result of soil losses by erosion the productivity was reduced and the difficulties of working and conserving the soil greatly increased. With proper management, including the selection of suitable crops, the use of a relatively long rotation, adequate fertilization, and possibly the use of mechanical means of runoff control, this soil can be made to produce fairly good yields of pasture and hay crops.

Cumberland gravelly fine sandy loam, eroded sloping phase.—This soil has a more sloping relief than the typical soil and has lost 50 to 75 percent of the original surface layer by erosion. The subsoil is exposed in some places, and the plow layer of most of the soil includes some subsoil material. Eroded sloping gravelly areas of the Waynesboro, Nolichucky, and Holston soils are included in this phase because of their limited area and similar position and suitability for agricultural use.

The relief of this soil is sloping or rolling, the gradient ranging for the most part from 5 to 12 percent. Internal drainage is good, but surface drainage is sufficiently excessive to facilitate erosion when the soil is not properly protected.

Most of the 768 acres mapped is associated with other Cumberland and Waynesboro soils, and a large part of it is northeast of Roddy, northwest of Watts Bar Dam, and south of Euchee School.

All the land has been cleared and cropped at some time, but a part is now abandoned and occupied by a brushy cover of sassafras, persimmon, briers, and broomsedge (fig. 9, *A*). That part under cultivation is used chiefly for corn, some small grains, hay, strawberries, and tomatoes. The natural productivity is fairly good, and under proper management good yields can be obtained. The more gravelly and sloping parts are more difficult to work, and control of runoff is a serious problem if the soil is tilled frequently.

Cumberland silty clay loam, eroded phase.—This soil has lost from 50 to 75 percent of the surface layer by erosion. The subsoil is exposed in some places, and over most of the area there is some of the more reddish subsoil material intermixed in the plow layer. The relief is undulating, and both surface and internal drainage are good.

The aggregate area of 384 acres is widely distributed in small-to-moderate-sized areas throughout much of that part of the county represented by the Talbott-Colbert-Waynesboro soil association.

All this soil has been cropped at some time, and most of it is being cropped now. General farm crops, as corn, wheat, oats, lespedeza, red clover, and alfalfa, are grown, but very little acreage is used for truck crops. Crop yields are good.

This is a productive soil, but owing chiefly to the loss of a considerable part of the fertile original surface layer its productivity is lowered. The subsoil material now incorporated in the plow layer makes for somewhat more difficult workability, and the problem of conserving the fertility and soil material is more difficult because of reduced fertility and the slow permeability of the exposed subsoil material.

Included with this soil is a small acreage of Cumberland silt loam too small to be mapped separately. This is the fertile brownish-red

FIGURE 9.—*A*, Idle Cumberland gravelly fine sandy loam, eroded sloping phase, near Carp School, south of Spring City. Following farming for a considerable time, productivity was reduced by erosion and failure to maintain fertility. *B*, Dewey silt loam is one of the best soils for general farming in the county. Good crops of corn and mixed red clover and lespedeza occupy most of this soil as pictured near Yellow Creek Church south of Spring City.

soil on some of the terraces. The 8- to 10-inch surface layer is brown to reddish-brown friable silt loam underlain by reddish-brown friable but firm silty clay loam, which grades into more nearly dark-red silty clay below a depth of about 20 inches. Small dark-brown concretions are common throughout these sublayers. Below a depth of about 48 inches is mottled or variegated yellowish-red, yellow, and brown silty clay or silty clay loam. Irregular gravel beds are at depths varying from 4 to 10 feet in some places, and a few pieces of gravel or cobbles are common on and throughout the soil mass in places.

The relief is undulating, the gradient seldom exceeding 5 percent. Both surface and internal drainage are good, although the movement of moisture through the soil is somewhat retarded.

Practically all of this soil is cleared and used for crops. Corn, small grains, and hay, including alfalfa, are the most common crops. It is productive and is easily worked, and the problem of conserving both the plant nutrients and the soil material is not difficult. It is suited to practically all crops commonly grown, and yields are comparatively high. Corn under average conditions yields 35 to 40 bushels to the acre, wheat 18 to 22 bushels, lespedeza 1 to 1½ tons, and alfalfa 3 to 3½ tons. Although truck crops are not generally grown, the soil is suited to most of them. Some fertilization is practiced, and to obtain continuous good yields, especially of such crops as alfalfa, at least moderate applications of phosphate and lime are required. Crop rotations of medium length, including corn, small grain, and hay, are commonly followed, although under some circumstances row crops are grown continuously for several years.

Cumberland silty clay loam, eroded sloping phase.—This soil has a slope of 5 to 12 percent and has lost from 50 to 75 percent of the original surface soil by erosion. The subsoil is exposed in places, and the plow layer of most areas is composed in part of subsoil material. The thickness of the original surface layer is variable, being particularly shallow or absent on the exposed knobs and thicker on the smoother parts and along the drainageways.

External drainage is excessive, and internal drainage is good, but absorption is slower than for the normal type, chiefly because of the loss of the more permeable surface soil material.

The aggregate area of 768 acres is associated with the other Cumberland soils and is widely distributed throughout much of that part of the county represented by the Talbott-Colbert-Waynesboro soil association.

All this soil has been cleared and cropped, and much of it is used for crops now, although some is lying idle. General farm crops, especially corn, small grains, lespedeza, red clover, and alfalfa, are grown, but very little is used for truck crops. Crop yields for the most part are good but are lower than those obtained on Cumberland silty clay loams, eroded phase. Yields are particularly low where the subsoil material is exposed, chiefly because of the more sloping character and the inclusion in the plow layer of some of the heavier subsoil material. The workability is more difficult, and the problem of conservation greater than for the normal types. Particular attention should be given to the control of water on the land to reduce the hazard of runoff. It may be that under some circumstances, mechanical means of controlling runoff are justified. Long rotations composed chiefly of close-growing small grains and hay and pasture crops are to be preferred. (See fig. 8, *A*.)

Cumberland silty clay loam, severely eroded sloping phase.—This soil is more sloping than the normal soil and has lost all of its original surface layer and in some places part of the subsoil. Included in this phase are also the few severely eroded sloping areas of Waynesboro, Nolichucky, and Holston soils. They were included with this phase of the Cumberland soils because of their limited area and somewhat similar position and suitability for agricultural use.

The slope ranges from 5 to 20 percent, and because of this strong slope and the absence of the more permeable surface layer, a large part of the moisture that falls on it is lost as runoff.

Most of the areas of the 896 acres mapped are small and are associated mainly with other soils of the Cumberland series and are represented by the Talbott-Colbert-Waynesboro soil association.

All this soil has been cropped, but most of it is now used either as pasture or lies idle. These latter areas are covered by a brushy growth of sassafras, persimmon, broomsedge, and briers, and the areas used as pasture support only a fair type of pasture plants. A few areas have a good stand of reestablished shortleaf pine. The limited acreage cropped is used chiefly for corn, small grain, and lespedeza for hay. Yields of all crops are low except where effective management and fertilization have been used.

This soil is of relatively low productivity and is difficult to work, and its proper conservation, especially when tilled, requires considerable effort. The condition of the subsoil material, which now makes up the plow layer, is not conducive to good plant growth and contributes to the difficulty of proper tillage. Moreover, soil losses under frequent tillage are difficult to keep at a minimum. For these reasons, this soil is poorly suited to crops that require tillage. With proper seeding and management most areas are capable of supporting good pasture; the more severely eroded steeper parts, however, may be best utilized as forest land, at least until the soil is sufficiently rejuvenated to support a grass cover.

Dewey silt loam.—The 8- to 14-inch surface layer is grayish-brown or brown mellow silt loam underlain by red or brownish-red firm but moderately friable silty clay to a depth of about 5 feet. The underlying material is moderately dense silty clay that is reddish yellow splotched with brown and gray. Bedrock limestone is at a depth of 10 to more than 30 feet. A few chert fragments are commonly in the subsoil, and a few small areas have an appreciable quantity of chert in the surface layer.

The relief is smooth or gently rolling, and both surface and internal drainage are good. Most of the areas are in valley positions represented by the Talbott-Allen-Lindside and the Talbott-Colbert-Waynesboro soil associations. Some of the larger areas are in the vicinity of Yellow Creek Church and about 1½ miles east of Spring City. The total area is 128 acres.

Practically all of this soil has been cleared and is now tilled. It is well suited to practically all crops common to this section. General farm crops including corn, wheat, oats, red clover (fig. 9, *B*), and alfalfa predominate, and a considerable part of the alfalfa grown in Rhea County is on this soil. Although suited to truck crops, the acreage used for this purpose is small.

Dewey silt loam is one of the most productive soils, and yields of all crops are relatively high. Under average conditions and common management practices corn yields 30 to 50 bushels an acre, wheat, 14 to 22 bushels, and alfalfa 2 to 4 tons. Although small quantities of fertilizer and some manure are generally used at intervals for other general farm crops, special preparation including the application of lime, phosphate, and manure is almost invariably given the soil for alfalfa.

The smooth relief, the mellow permeable silt loam surface layer, and the thick fertile subsoil contribute to the good workability and ease of conservation. Although this soil has relatively high natural fertility, good results are obtained from the application of phosphorus, lime, and manure.

Dewey silty clay loam, eroded phase.—This soil has a rolling relief with a gradient of 5 to 12 percent. It has lost 50 to 75 percent of its original surface soil. The subsoil is exposed in some places, and the plow layer of most of the acreage includes some subsoil material. Chert fragments, although of relative insignificance to the agricultural use of the soil, are more common than on Dewey silt loam. Both surface and internal drainage are favorable for all crops.

The aggregate area of this eroded phase is 1,344 acres. It is associated with the other Dewey soils and the areas are widely distributed throughout those parts represented by the Talbott-Colbert-Waynesboro and Talbott-Allen-Lindside soil associations. Most of the areas are of small to moderate size, few occupying more than 30 or 40 acres.

All this soil has been cleared and cropped at some time. Part of it now lies idle and is occupied by a mixed brushy cover of sassafras, persimmon, broomsedge, and briers. A large part of it is used for those general farm crops commonly grown on Dewey silt loam. The productivity is slightly lower than on Dewey silt loam, and chiefly because of the stronger slope and higher clay content of the exposed subsoil material, moisture relations are less favorable for good crop growth. The workability is likewise a little more difficult, and the problem of conservation requires more attention than on the normal types. In general long rotations are to be preferred in order to keep the soil covered most of the time with a close-growing vegetative cover. Contour tillage is valuable in controlling runoff, and under some circumstances mechanical means may be desirable.

Crops, especially legumes, respond well to applications of phosphate and lime. Barnyard manure is of especial value for the rejuvenation of this soil and is generally used with lime and phosphate in establishing stands of alfalfa.

A small acreage of Dewey silty clay loam, severely eroded phase, too small to map, is included with this phase. This phase has lost practically all of the surface soil and in some places part of the subsoil.

Dewey silty clay loam, eroded hilly phase.—This soil has a hilly relief, the gradient ranging from 12 to 30 percent. It has lost from 50 to 75 percent of the original surface layer. The subsoil is exposed in some places, and the plow layer of most of the soil contains some subsoil material. Gullies are not uncommon but are not so numerous or of such size as to prohibit field operations entirely. In general, the thickness of the surface and subsoil layers is more variable and the depth to bedrock averages a little less in the eroded hilly phase than in the smoother Dewey soils.

Internal drainage is moderately rapid, but external drainage is excessive. The strong slope and the shallower previous surface layer cause the damage from runoff to be much greater than on Dewey silt loam.

The aggregate area of this soil is 896 acres. Most of the areas are small and many of them lie as single slopes associated with Fullerton

soils and the smoother soils of the Dewey series. One of the larger areas is about 1 mile east of Graysville.

All of this soil has been cleared and cropped, but a part of it now lies idle or is used as native pasture. That part now cropped is used for corn, some small grain, and certain hay crops. Crop yields in general are only fair as compared with those obtained on Dewey silt loam.

The natural productivity is impaired by the less fertile condition and less favorable moisture relations of the plow layer, and the workability is only fair to poor, because of the strong slope, heavier and more variable consistence of the plow layer, and in some places because of gullies. The conservability is poor. Special attention is required to rebuild the fertility; the heavier consistence requires more care in preserving favorable tilth, and the increased runoff and the low permeability of the surface soil increase the hazard of erosion.

If properly managed and fertilized, this soil is capable of producing fairly good yields of many of the crops. Means of increasing the fertility and diminishing the runoff are among the management requirements that need first attention. Rotations consisting of close-growing small grains and hay crops are preferred, and special attention should be given to keeping a good vegetative cover on the ground through the winter season. Practically all crops can be expected to respond well to heavy applications of phosphorus, lime, and manure. Although fair volunteer pasture commonly establishes itself, considerable improvement in both quantity and quality can be expected from proper seeding and fertilization.

Dewey silty clay loam, eroded undulating phase.—This soil has lost much of the surface soil. The subsoil is exposed in places, and the plow layer over most of the areas includes some subsoil material.

Most of the areas of 576 acres mapped are of small to moderate size. These areas are associated with the other Dewey soils and are widely distributed over those parts represented by the Talbott-Colbert-Waynesboro and Talbott-Allen-Lindside soil associations. All has been cleared and cropped at some time, and most of it is now used for general farm crops including corn, wheat, oats, red clover, and alfalfa. It is a fairly productive soil, but its eroded condition is responsible for somewhat lower yields than are common to Dewey silt loam. Although it is suited to the same uses, the requirements for proper conservation are somewhat more exacting from the standpoint of intensity of cropping, fertilization, and control of runoff. Owing to its smoother surface, the difficulties of working and conserving this soil are not so great as on Dewey silty clay loam, eroded phase.

Dewey silty clay loam, severely eroded hilly phase.—This soil has a hilly relief with slopes ranging from about 12 to 30 percent. It has lost practically all of its original surface layer and in some places part of the subsoil. The plow layer consists of reddish-brown or brownish-red moderately friable silty clay underlain by red or reddish-brown silty clay material similar to that of the subsoil of Dewey silt loam. Chert fragments are common in some areas, but they are not sufficient to interfere with cultivation.

Surface drainage is excessive, but internal drainage is entirely adequate for good crop growth.

The aggregate area is 128 acres. Most of the areas are small, but the largest of these are in the vicinity of Concord School.

During the first few years following the breaking of this soil, good yields of practically all crops common to this section were obtained. Its productivity now, however, is relatively low, and its suitability is limited. All of it has been cropped at some time, but a considerable part of the acreage now lies idle or is used as pasture. Its carrying capacity as pasture is low. A part of it is used for general farm crops such as corn, small grains, and hay, and yields of these crops under average conditions and common management practices are low.

Observations indicate that this soil can be improved for agricultural use. Increasing its fertility, improving its tilth, and controlling the water appear to be the chief requirements of the proper management of this soil. Its strong slope and poor tilth especially limit its suitability for tillage; consequently row crops are poorly suited to it. A rotation comprised almost entirely of close-growing small grains, hay, and pasture crops may be suitable after the productivity has been improved substantially, but in most circumstances permanent pasture is a better use for it. If a rotation of close-growing crops is used, particular care should be taken to keep a good cover crop on the land through the winter season and to carry on tillage and other field operations on the contour. It may be advantageous under some conditions to practice other means of controlling runoff such as subsoiling and terracing. Fertilization is necessary if good yields, an effective vegetative cover, and good quality grazing are to be obtained. Phosphate and lime are the chief fertilizers needed, but where available manure is of value in rebuilding the productivity. Proper seeding as well as fertilization is necessary in establishing pastures of good quality.

Dunning silty clay loam.—This is the dark-colored heavy poorly drained soil of the first bottoms of the limestone valleys. It is comprised of material washed chiefly from Talbott and Colbert soils. The 12-inch surface layer is a very dark-gray, dark-brown, or nearly black plastic silty clay loam or clay; when dry this material is hard and cracked. To a depth of 18 to 22 inches, the material is a little darker and more plastic. The underlying material is olive-drab mottled with yellow and dark-brown very plastic clay. The reaction throughout the entire soil is neutral to slightly alkaline.

The relief is nearly level, internal drainage is poor, and most of the areas are in slight depressions that are subject to inundation by normal floods.

Most of the 960 acres mapped lies as small areas associated with the Lindside soils of the first bottoms along the creeks in those parts of the county represented by the Talbott-Colbert-Waynesboro and Talbott-Allen-Lindside soil associations.

A large part of the acreage is used as pasture for which it is well suited. Some of the better drained parts are tilled, and corn is the principal crop. The suitability of these better drained areas for crops is limited by inadequate drainage and poor tilth. The high natural fertility makes this a strong soil, and good yields of corn and hay crops as lespedeza, redtop, and timothy are commonly obtained on the better drained parts. Good pastures are easily maintained, provided a desirable kind of vegetation is established and weed and brushy

growth is suppressed. It is possible that the productivity for crops and the range of suitability of many areas could be substantially increased by artificial drainage, but the advantages of such improvement must be carefully weighed against the cost and the value of this land in its undrained state as pasture land.

Egam silty clay loam.—This soil is associated with Huntington and Lindside soils and is distinguished by its dark compact subsoil. The 8- to 18-inch surface layer is grayish-brown silty clay loam of rather heavy consistence. Below this and extending to a depth of about 24 inches is dark-brown or nearly black compact clay that is sticky when wet. At this depth, the material grades into mottled brown, gray, and olive-drab clay that is less compact than the layer above. Below a depth of about 30 inches is mottled gray, yellow, and brown clay that becomes grayer with depth.

The relief is nearly level to very gently undulating. Both surface and internal drainage are slow, but they are adequate under average conditions for such crops as corn and lespedeza. All areas are subject to inundation by the larger floods, and when flooded in the spring they generally remain too wet for tillage for a considerable time, thus delaying spring field operations.

The aggregate area is 576 acres. The soil is associated with Huntington and Lindside soils of the first bottoms and with Wolftever soils of the adjoining low terraces or benches. It is common to the bottoms along the Tennessee River, and a considerable acreage is in the vicinities of Eaves and Cotton Port Ferries. This soil and its associates make up a landscape that is characterized by a smooth relief subject to flooding, moderate to high fertility, and generally good suitability for crops that require tillage.

Practically all of this soil is cleared and cropped. It is a productive soil and presents no difficult problems of conservation, but its suitability for crops is limited. Corn, hay, and to a less extent oats are the principal crops grown. Average yields of corn are 35 to 45 bushels an acre, hay 1 to 1½ tons, and oats, when not damaged by flooding, 20 to 30 bushels under common management practices. Corn is often grown several years in succession, and little fertilization is practiced. Some phosphate has been applied for corn by a few farmers. Natural or seeded pasture may be expected to do well, but most pasture crops probably will suffer during the dry late-summer period.

The unfavorable tilth of the plow layer and the compact nature of the subsoil are probably the most undesirable features of this soil. Tillage practices require considerable power, and care must be taken to work the soil when moisture conditions are most favorable. The compact nature of the subsoil interferes with proper movement of soil moisture and, as a consequence, prolongs the effect of periods of excess moisture and intensifies the effect of dry periods. Tilth conditions may be improved by increasing the content of organic matter of the plow layer, and the compact nature of the subsoil may be reduced by deep tillage or subsoiling and by the growing of hardy deep-rooted crops.

Emory silt loam.—This is a fertile reddish-brown soil occupying gentle valley slopes of colluvial-alluvial material and associated with the red soils overlying limestone. The surface material to a depth of

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10 to 14 inches is brown to dark reddish-brown friable silt loam. The underlying material, which extends to a depth of about 24 inches, is reddish-brown to yellowish-brown firm but friable silty clay loam. Below this the material is variable but for the most part is variegated yellow, brown, and gray silty clay.

The relief is gently sloping, the gradient seldom exceeding 5 percent. Most of the areas lie as gentle slopes in the heads of draws and along drainageways and consequently are subject to runoff from the surrounding higher lying soils of the upland, except where ditches or waterways have been sufficiently developed to take care of this excess water The runoff, where not conducted by ditches, generally desposits additional soil material on the Emory soils from the adjoining upland. Internal drainage is good.

The aggregate area is 576 acres. Most of the areas are small and, although not numerous, are widely distributed over those parts of the county represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. The soils adjacent to areas of Emory silt loam are generally rolling to hilly and at least moderately eroded, although the two soil associations in which they occur are among the more productive parts of the county.

Practically all of this soil is cleared and cropped. Corn is the chief crop, but hay including alfalfa, small grains, tobacco, tomatoes, and sorghum are of some importance. It is a productive soil, is easily worked, and its conservability is good, therefore, row crops are often grown and little fertilizer is used. Under common management practices corn yields 30 to 50 bushels an acre, and other crops give correspondingly high yields.

Emory silt loam, sloping phase.—This soil has a sloping surface of 5 to 12 percent. The surface layer of many areas is thinner, a little lighter colored, and of a lower content of organic matter than the typical soil. The productivity accordingly is a little lower, and because of its stronger slope its workability and conservability are not so good. More care should be taken to control runoff, and under most circumstances row crops should be grown less frequently. Approximately the same crops are grown as on the typical soil. Yields are good, although they average slightly less than those for the normal type.

Most of the 512 acres mapped are in small areas, which are generally associated with those of the typical soil and are widely distributed throughout that part of the county represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. Practically all of the acreage is cleared and used for crops.

Etowah silt loam.—This soil is a smooth fertile brown soil on medium to low terraces or benches along the Tennessee River and some of the larger tributaries. The 10- to 16-inch surface soil is grayish-brown or yellowish-brown friable silt loam. Below this and to a depth of about 40 inches is yellowish-brown to reddish-brown moderately firm but friable silty clay grading to sandy clay loam in a few places. The underlying material is yellowish-brown splotched with gray and yellow friable silty clay. There are a few pieces of gravel or cobbles intermixed with the soil material in places, but they are less common than in some of the Waynesboro, Nolichucky, and Cumberland soils.

The relief is undulating to gently rolling, the gradient seldom exceeding 5 percent. Internal drainage is good. The 64 acres mapped lie on medium to low terraces, especially along the Tennessee and Piney Rivers, and there are a few areas on alluvial terraces throughout those parts of the county represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. A few of the lowest lying areas are subject to inundation during extremely high floods.

Practically all of this soil is cleared and used for crops. General farm crops as corn, oats, wheat, soybeans, peas, and hay, including red clover and alfalfa, occupy a large part of the acreage. Vegetables are grown in some parts of the county. Rotation of crops including row crops, small grain, and hay is common, and some fertilization is practiced. Barnyard manure is used where it is available, and phosphate and lime are commonly used for alfalfa.

Etowah silt loam is a productive soil. Its workability and conservability are good, and it is well suited to a wide variety of crops. The areas on the lower terraces are generally more fertile than those on the higher terraces, but average yields on all areas are relatively high and approximate those obtained on Dewey silt loam. Under common management, corn yields 35 to 45 bushels to the acre, oats 35 to 45 bushels, and alfalfa 3 to 3½ tons. Response to proper fertilization, especially with manure and phosphate, and, for certain legumes such as red clover and alfalfa, to applications of lime, may be expected.

Etowah silty clay loam, eroded phase.—This phase has lost from 50 to 75 percent of its original surface. The subsoil is exposed in places, and the plow layer for the most part includes some subsoil material.

The relief is gently rolling, and internal drainage is good. The aggregate area is 1,152 acres. It is associated mainly with the other Etowah soils and along the Tennessee River with the Wolftever soils, and throughout those parts of the county represented by the Talbot-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations.

All of this soil has been cleared, and most of it is being used for crops. It is used in the same manner as the normal type, but yields average a little lower. It is well suited to crops, but chiefly because of its eroded condition somewhat more attention is required to conserve it properly. Because of the less favorable texture and consistence of the subsoil material included in the plow layer, the workability is less favorable than that of the typical soil. Good response to proper fertilization, especially with manure, phosphate, and lime may be expected. Heavy applications of manure are especially beneficial on the more eroded parts.

Etowah silty clay loam, eroded sloping phase.—This soil has a stronger slope than Etowah silt loam and has lost from 50 percent to practically all of the original surface layer. As a result, the subsoil is exposed in many places and the plow layer of all of it is composed in part of subsoil material. The relief for the most part is sloping, the gradient ranging from 5 to 12 percent. Internal drainage is retarded but is adequate for all crops. Runoff is excessive and presents a serious problem of conservation.

The aggregate area mapped is 640 acres and represents nearly half of the total area of the Etowah soils. It is associated with the other

Etowah soils and is widely distributed along the Tennessee River and throughout those parts of the county represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations.

All this soil has been cleared and cropped, but many areas are either lying idle or are used as unimproved pasture. The idle areas for the most part are covered by a brushy growth of sassafras, persimmon, broomsedge, and briers. Areas that are tilled are used chiefly for general farm crops as corn, small grains, and hay. Owing to the variable degree of erosion, the suitability of this soil varies considerably. The less eroded parts are productive of most of the general farm crops, but the more severely eroded parts produce only fair yields, except where special attention has been given to their improvement. Most areas are considerably more difficult to work, and all of them require more effort for proper conservation than those of Etowah silt loam. In general row crops should not be grown frequently, tillage should be on the contour, and the soil should be protected as much of the time as possible by close-growing crops that afford good cover through the winter seasons. Good response to proper fertilization can be expected.

Fullerton cherty silt loam.—This loam has sufficient chert fragments in the surface layer to interfere materially with tillage operations. The 12- to 16-inch surface layer is grayish-brown to gray cherty silt loam underlain by yellowish-brown to yellow-red firm but brittle cherty silty clay to a depth of about 36 inches. The material below this is splotched reddish-yellow, yellow, gray, and brown firm but brittle silty clay. Bedrock of cherty dolomitic limestone is at a depth of 5 to more than 40 feet.

The relief is rolling, the gradient ranging from 5 to 12 percent. Internal drainage is good. Although its total area of 2,368 acres is not large, it is widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association, especially along the southeastern and northwestern edge of this part of the county.

A large part of this soil has been cleared and cropped, and much of it at sometime has been used for strawberries. Corn, small grains, lespedeza, redtop, strawberries, tomatoes, and some peaches and apples are the principal crops. Strawberries generally are grown on newly cleared areas for 2 or 3 seasons, after which the land is again abandoned or is used for general farm crops. During recent years some strawberries have been grown with more care, including adequate fertilization. Yields under these conditions are good. General farm crops are rotated but not according to any definite plan, and fertilization for these crops is at long intervals and generally is light. Practically all crops respond well to fertilization; phosphate and lime are the most limiting. A few acres of commercial apple and peach orchards are on this soil, and the trees appear to be producing well. The orchards have better fertilization and management than are commonly practiced for general farm crops.

The natural productivity of this soil is moderately low, and average yields of general farm crops are a little less than those obtained on Fullerton silt loam. Under common management corn yields 15 to 20 bushels an acre, wheat about 10 bushels, lespedeza hay ½ to 1 ton, and strawberries about 40 crates of 24 quarts each. Tomatoes yield well under good management, but yields generally obtained are low.

The workability is somewhat impaired by the abundance of chert and by the rolling nature of the land. Conservability is only fair. As with Fullerton silt loam, special attention and fertilization are necessary to build up and maintain fertility. The rolling relief presents difficulties in the control of runoff, and especially for this reason close-growing grains and grasses should be utilized as much as feasible to reduce the hazard of erosion.

Fullerton cherty silt loam, eroded phase.—This soil has lost from 50 to 75 percent of its surface layer. The subsoil is exposed in places, and the plow layer generally includes some subsoil material. The relief is rolling, and internal drainage is good.

The 3,712 acres mapped is widely distributed throughout that part represented by the Fullerton-Clarksville soil association and is associated for the most part with other members of the Fullerton series. It is one of the more extensive of the Fullerton soils, and generally lies as moderately large areas on the ridge tops.

All of this soil has been cleared and cropped at some time, but a considerable part of it now lies idle or is used as unimproved pasture. Much of the idle acreage is occupied by a brushy cover of sassafras, persimmon, broomsedge, and briers. The tilled part is used for general farm crops such as corn, oats, wheat, and lespedeza, and for truck crops as strawberries and tomatoes. The natural productivity of this soil is somewhat lower than that of the normal type, and crop yields under common management are a little lower. Its workability is only fair, because of the high content of chert, the rolling relief, and the patches of exposed subsoil material.

The proper conservation of this soil presents substantial problems. Erosion is a serious hazard under present systems of management; consequently, proper conservation will require adequate control of runoff water. Frequency of row crops should be reduced as much as feasible, and in their place close-growing small grains, hay crops, and winter cover crops should be grown. Where at all practicable, contour tillage is desirable, and under some circumstances it may be well to use other mechanical means to control runoff. As on other Fullerton soils, crops respond to fertilization, and if the productivity is to be raised and maintained at a relatively high level moderate to heavy applications of phosphorus and lime are necessary. Both of these materials are essential if such legumes as red clover and alfalfa are to be grown. Best results are obtained with these two crops where both phosphorus and lime have been used with moderate to heavy application of manure.

Fullerton cherty silt loam, eroded hilly phase.—This soil has a stronger slope than the normal Fullerton cherty silt loam and has lost from 50 to 75 percent of the surface layer. Relief is hilly, the gradient ranging from 12 to 30 percent. The subsoil is exposed in places, and the plow layer of practically all of it includes some subsoil material. Some small gullied areas are indicated on the soil map by appropriate symbols (fig. 10, *B*). Internal drainage is good.

The aggregate area of 4,544 acres is widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. Like the uneroded hilly phase, most of it lies on the ridge slopes. All of it has been cleared and cropped, but a large part

now either lies idle or is used as pasture (fig. 10, *A*). Crops are chiefly corn, small grains, lespedeza, and redtop. Yields under common management practices are fair to low, depending to some extent on the degree of erosion and exposure. Volunteer vegetation has only fair quality for pasture, but with proper fertilization and seeding a fairly good pasture cover can be established.

FIGURE 10.—*A*, Extensive areas of the hilly Fullerton soils, when abandoned after several years of tillage, are soon covered by broomsedge, briers, sassafras, and other shrubby growth and are of little value even for grazing. View 1 mile east of Pleasant Dale School east of Evensville. *B*, Fullerton cherty silt loam, eroded hilly phase, if not carefully managed, is easily damaged by runoff. Gully erosion of this character 3½ miles southeast of Spring City has developed where row crops have been grown continuously and little effort has been made to control the water on the land.

Fullerton cherty silt loam, eroded steep phase.—The steep slopes have lost 50 percent or more of their original surface layer and in some places a part of the subsoil. Gullies are common in places, and a few are difficult or impossible to cross with farm machinery. The depth to bedrock is variable—in places only a few feet from the surface. Internal drainage is good.

The aggregate area is 1,984 acres. The areas are small and are widely scattered throughout that part of the county represented by the Fullerton-Clarksville soil association. All of it has been cleared and cropped, and many tracts were used chiefly for strawberries. A

large part of it now lies idle and is covered either by a brushy growth of sassafras, persimmon, broomsedge, and briers or by pine.

Because of its low productivity, poor workability, and poor conservability this soil is poorly suited to either crops or pasture. Where circumstances require, the more suitable areas may be satisfactory for pasture provided proper seeding and fertilization are carried out. Most of the soil is best suited to forest, at least for a sufficiently extended period of years to permit an appreciable rejuvenation of the natural fertility and tilth of the surface layer.

Fullerton cherty silt loam, hilly phase.—This soil has a stronger slope than the normal type, the gradient ranging for the most part from 12 to 30 percent. The surface layer in general is more variable in thickness and averages less than that of the normal type. Extremely cherty areas are more abundant.

The aggregate area of 2,624 acres is widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. Whereas most of the Fullerton soils having a rolling relief (5 to 12 percent) are on ridge tops, much of the acreage of the hilly phase is on the ridge slopes.

Only a small part has been cleared and tilled, and the forest cover on most of it is hardwoods, chief of which are oaks. Under present conditions most of the uncleared part can well be retained as forest land, but if it is needed for agricultural use it is better suited to pasture than to crops. Its productivity when first cleared is fairly good, but unless properly managed its ability to produce declines rapidly. Some fertilization with phosphate and lime and proper seeding should do much to insure good pasture on newly cleared areas.

Poor workability and conservability are the main reasons that this soil is not considered well suited to crops that require tillage. Its strong slope and cherty nature make field operations difficult. The slope and the difficulty of maintaining fertility make conservation difficult under a system of management involving the use of crops that require tillage. If circumstances require its use for such crops, long rotations including chiefly close-growing small grains, hay, and cover crops and pasture are to be preferred. Phosphorus and lime are essential for the maintenance of productivity, especially if such legumes as red clover, crimson clover, and alfalfa are to be grown.

Fullerton cherty silt loam, severely eroded phase.—Practically all of the surface layer has been lost and in places a part of the subsoil. Gullies of variable size are common but are not sufficiently large or numerous to preclude tillage. The relief is rolling, and owing chiefly to the absence of the more permeable original surface layer, absorption of water is considerably impaired, therefore, runoff is greater than on the normal type. This condition and the generally poor vegetative cover result in a marked erosion hazard.

The aggregate area is 128 acres. The separate areas are small but are widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. All of it has been cleared and cropped, but a large part now lies idle and is covered by a brushy growth of sassafras, persimmon, broomsedge, and briers. A few areas have a good stand of pine.

The few areas cropped are used chiefly for corn, small grain, and lespedeza and redtop hay. Yields are low except where special ef-

fort has been made to improve the physical character and increase the fertility of the soil. Because of the poor tilth of the subsoil material and the rolling nature of the land, the workability is poor, and the low fertility, poor permeability, and slope contribute greatly to making its proper conservation very difficult under a system of management involving frequent tillage. Until a fairly high state of fertility and improved workability are established, this soil should be used either for pasture as much as feasible or for forest. If it is to be used for pasture, proper fertilization and seeding are necessary as the volunteer cover is of low quality and low-carrying capacity. Both phosphorus and lime are essential to the establishment of good pastures. It is probable that kudzu can be of considerable value.

Fullerton cherty silt loam, severely eroded hilly phase.—The hilly relief has lost practically all of its original surface soil and in some places part of the subsoil. The plow layer is composed almost entirely of subsoil material, and gullies are common. Some of the gullies are difficult or impossible to cross with heavy farm machinery. The gradient ranges from 12 to 30 percent, and runoff under average conditions is excessive, chiefly because of the strong slope and absence of the more permeable original surface layer.

The aggregate area is 704 acres. The soil is widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. Most of the areas are small and generally represent the most severely eroded patches among the other hilly Fullerton soils.

All this soil has been cleared and cropped, and much of it was used for strawberries. Much of it now lies idle or has a fairly good stand of pine. It is very poorly suited to crops that require tillage, because of its low productivity, its very poor workability, and the difficulty of conserving the fertility and the soil material. Under most circumstances, the soil can best be used as forest land. If it is needed for crops, long rotations including chiefly close-growing small grains and hays and pasture are preferred. Careful tillage and heavy fertilization are necessary if good yields are to be obtained and the soil is to be properly conserved. All field operations should be on the contour, and the surface should be protected as much as possible by a good vegetative cover. Although volunteer pasture is of poor quality and low yield, fairly good pasture can be obtained by proper seeding and fertilization. Lespedeza, redtop, and orchard grass are among the more easily established hay and pasture crops, but if heavy fertilization including manure, phosphate, and lime is made, such plants as white clover, red clover, bluegrass, timothy, and alfalfa may be grown successfully.

Fullerton cherty silt loam, undulating phase.—This phase has a smoother relief than the normal type, the gradient seldom exceeding 5 percent. In general, the thickness of the surface layer is more uniform and somewhat greater than that of the normal type. Both surface and internal drainage are good, and erosion is not a serious hazard on areas that are tilled.

The aggregate area of 512 acres is widely distributed over that part represented by the Fullerton-Clarksville soil association, and it is associated chiefly with other Fullerton soils. Most of the areas are small and lie for the most part on the broader parts of the ridges.

A considerable part is cleared and cropped, although an appreciable acreage is still occupied by forest. Most of the tilled acreage is used for general farm crops such as corn, small grains, lespedeza, and such truck crops as strawberries and tomatoes. Crop yields under common management practices and natural productivity of this soil approximate those of the normal type, and observation and experience indicate that this phase responds well to proper fertilization and management. The large quantity of chert in the soil interferes with tillage operations somewhat but not sufficiently to prohibit tillage. Conservability of soil material is good, but if a high productivity level is to be obtained considerable effort must be made to increase and maintain its fertility. Heavy applications of phosphorus and lime are essential in building up the productivity, and the content of organic matter could well be improved by the use of manure and the turning under of winter cover crops.

Fullerton silt loam.—The surface layer of Fullerton silt loam is a brownish-gray silt loam. Below a depth of about 10 inches is reddish-yellow to yellowish-red firm but brittle moderately cherty silty clay grading into splotched yellowish-red, yellow, brown, and gray moderately cherty rather tight silty clay at a depth of about 36 inches. Bedrock of cherty dolomitic limestone occurs from 5 to more than 30 feet below the surface.

The relief of this soil is undulating to gently rolling, the gradient seldom exceeding 5 percent. Internal drainage is good.

The aggregate area of 320 acres is associated with other members of the Fullerton series and with the Clarksville soils. In some parts of the county Dewey soils are associated with it. Practically all of the areas are on ridge tops in those parts represented by the Fullerton-Clarksville soil association. Few of them occupy more than a small acreage. They are a part of a rolling to hilly landscape, the soils of which range widely in their suitability for agricultural use.

Much of Fullerton silt loam is used for crops, although a small part is still occupied by forest. Corn, small grains, lespedeza, redtop, and strawberries are the principal crops. A small quantity of sericea lespedeza has been grown with satisfactory results. Although crops are rotated, no plan is followed consistently. The natural productivity of this soil is fair. Under common management practices, which include irregular and rather small applications of fertilizer or manure, corn yields about 25 bushels an acre, wheat about 12 bushels, and lespedeza about 1 ton. Strawberries and tomatoes yield well under good management, but they are commonly grown under poor management and yields are poor. Good response to proper fertilization is generally obtained. Both lime and phosphate are very beneficial to most crops, including pasture, and are necessary if good stands of alfalfa or red clover are to be established. Results on areas of Fullerton soils in the vicinity of Rhea County have given yields of alfalfa ranging from 2 to 3 tons to the acre where substantial applications of manure, phosphate, and lime have been made. Corn, under similar treatment, yields about 40 bushels an acre.

This soil is easily worked; the surface is smooth and the tilth of the plow layer is good. The problem of conserving the soil material against erosion is not serious, although the maintenance and building up of its fertility does require heavy fertilization and good

management. It is probable that the frequency of row crops could well be reduced in favor of legume hay, pasture, and cover crops to benefit the soil.

Greendale cherty silt loam.—This soil is cherty, and the slopes range for the most part from 5 to 12 percent. There is a limited acreage of less sloping soils. Chert fragments are sufficiently abundant to interfere materially with field operations. Surface drainage on the more sloping parts is slightly excessive, but internal drainage, although somewhat retarded, is adequate for all crops commonly grown.

The aggregate area is 1,472 acres. The separate areas for the most part are small, but are widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. Most of the areas are associated with the Clarksville soils.

A large part of this soil is cleared and cropped, and much of it is used for general farm crops, especially corn and hay. Some of it is used for truck crops, and those areas on farms having a very limited acreage of soils suitable for tillage are used intensively for corn, sorghum, and truck crops.

The natural productivity of this soil is lower than that of the silt loam type, and crop yields are correspondingly lower. Unless the soil is fertilized heavily, it is not well suited to crops as red clover and alfalfa. Its workability is not so good as that of Greendale silt loam, because of the abundance of chert fragments; its conservability is not so good, because of its lower state of fertility and more sloping relief.

Greendale silt loam.—The 10-inch surface layer is yellowish-gray silt loam. Below this and to a depth of about 26 inches is brownish-yellow moderately friable but firm silty clay loam underlain by mottled yellow and gray firm silty clay that becomes grayer with depth. There is generally a small quantity of chert throughout the upper part, and a moderate to large quantity in the lower part. In some places the gradation from the grayish surface layer to the firm yellowish subsoil is not pronounced.

The relief of this soil is gently sloping, the gradient seldom exceeding 5 percent. Surface drainage is good, and internal drainage, although noticeably impaired, is adequate for all crops commonly grown. Most areas receive runoff from the adjoining higher lying soils and are benefited by seepage water from these adjoining areas, therefore, their moisture relations are more favorable for crops than those of most of the uplands.

The aggregate area is 2,560 acres. The separate tracts are small but are widely distributed throughout that part of the county represented by the Fullerton-Clarksville soil association. The areas lie along the upland drainageways and on colluvial fans.

A large part of the acreage is cleared and cropped and is well suited to crops requiring tillage. It is fairly productive, is easily worked, and its use as cropland represents only moderate problems of conservation. This soil being of only medium fertility requires special attention in its management if its productivity is to be raised and maintained at a fairly high level, but the control of water on the land is not a serious problem.

Greendale silt loam is suited to many crops and uses. Those areas on farms consisting chiefly of the less productive, cherty, and steep Fullerton and Clarksville soils are used intensively for row crops as corn and sorghum as well as for truck crops (fig. 11, *A*). On those

FIGURE 11.—*A*, A large part of the Greendale and Roane soils (foreground) are associated with extensive areas of hilly to steep Clarksville soils (background). These smoother soils are commonly used chiefly for row crops. *B*, An excellent crop of soybean hay 2½ miles northeast of Dayton, on Greendale silt loam. Most of this soil is tilled, and under proper management produces good yields. Cumberland escarpment (Muskingum-rough stony land soil association) is in the background.

farms that have an appreciable acreage of other soils well suited to tillage, it is used for general farm crops as corn, wheat, oats, soybeans, lespedeza, and other hay crops as well as for truck crops

(fig. 11, *B*). The most common truck crops grown are snap beans, tomatoes, strawberries, and turnips. A small quantity of tobacco is also raised.

Crop yields under common management, which includes some kind of rotation and small infrequent applications of fertilizer or manure, are fairly good. Corn yields 30 to 40 bushels an acre, wheat, about 15 bushels, and lespedeza hay ¾ to 1¼ tons. Red clover and alfalfa are well suited to this soil provided a good state of fertility is established first. Applications of both phosphorus and lime are essential for good production of these crops, and it is a common practice to apply at least a moderate quantity of manure, especially for alfalfa. This soil provides good pasture when properly fertilized and seeded.

Guthrie silt loam.—This is a gray poorly drained soil occupying depressions associated with soils overlying limestone. The 7-inch surface layer is gray slightly mottled with brown and lighter gray mellow silt loam. Below this and to a depth of about 20 inches is gray mottled with brown and yellow silty clay loam that is moderately sticky when wet but is moderately friable under optimum moisture conditions. The underlying material is predominantly gray mottled to a variable degree with brown and yellow heavy plastic clay. Limestone bedrock is generally at a depth of 3 to 5 feet below the surface, and in some places, where it is associated with Colbert and Talbott soils, there are a few rock outcrops.

Most of this soil is derived from comparatively shallow colluvial-alluvial deposits composed of clayey plastic material washed from soils overlying limestone. The areas are nearly level. Outlets for surface drainage are not well developed, and most areas are subject to temporary flooding during periods of heavy precipitation. Internal drainage is very poor.

The aggregate area is 1,088 acres. The separate areas range in size from 1 to 40 or 50 acres and are widely distributed over those parts represented by the Talbott-Colbert-Waynesboro soil association, and a limited acreage is associated with the Fullerton-Clarksville soils. About half of the aggregate area has been cleared. The uncleared part has a deciduous forest cover of low value as timber. Most of the cleared part is unimproved pasture, and the small part that is tilled is used chiefly for corn and such hay crops as lespedeza and redtop. Crop yields are low, and crop failures are common.

This soil is not well suited to crops requiring tillage, chiefly because of its low natural productivity and poor workability. Heavy applications of all the important plant nutrients are necessary, and the content of organic matter needs to be increased materially if good yields are to be obtained. The soil is strongly acid. Drainage is the principal limiting factor that will need to be improved if crops requiring tillage are to be grown, but owing to generally poor outlets and the heavy nature of the subsoil, artificial drainage is difficult to establish in most areas. With some improvement of surface drainage and proper fertilization and seeding, most areas are capable of affording good grazing.

Hanceville fine sandy loam.—This smooth well-drained sandy soil with reddish subsoil is associated with Hartsells, Muskingum, and Hector soils of the Cumberland Plateau. The 10-inch surface layer is yellowish-gray to grayish-brown loose fine sandy loam. Below this

and to a depth of about 20 inches is reddish-yellow friable sandy clay loam. The brownish-red subsoil grades to bright-red friable sandy clay loam that is sticky when wet and brittle when dry. Below a depth of 30 to 40 inches the material is more sandy and more yellow. Soft sandstone fragments are common to the lower part of this layer, and sandstone bedrock lies 35 to 50 inches below the surface.

Most areas of this soil lie on irregular slopes of 5 to 9 percent. Internal drainage is favorable for those crops commonly grown.

The aggregate area is 192 acres. Most of the areas are on narrow ridges, especially along the southeastern edge of the Cumberland Plateau. Those that are part of the broader smooth areas of the plateau are largely cleared and cropped to corn, small grains, soybeans, lespedeza, redtop hay, and some truck crops as potatoes, sweetpotatoes, tomatoes, beans, and strawberries; but those on narrow ridges associated with the steep Muskingum and Hector soils are for the most part still forested. Some sericea lespedeza has been raised and holds some promise as a hay crop. Crop yields under common levels of management are fair; corn yields 20 to 30 bushels an acre, lespedeza and redtop hay ½ to 1 ton, and potatoes about 80 bushels. General farm crops are generally rotated once in 3 to 5 years. They receive only a small quantity of fertilizer, but truck crops generally receive moderate applications. Under good management and fertilization, better yields are obtained. This soil is well suited to potatoes and truck crops in general.

Productivity and workability are fair, although the irregular slope is of some disadvantage. Because of its comparatively shallow depth to bedrock, its rolling relief, and only fair natural state of fertility, its conservability is only fair. If it is to be maintained at a fairly high productivity, regular fertilization must be practiced and care must be taken in its management to prevent erosion.

Hartsells fine sandy loam.—This is a smooth well-drained sandy soil with yellowish subsoil on the smoother parts of the ridges of the Cumberland Plateau. The 8-inch surface layer is brownish-gray or yellowish-gray loose fine sandy loam grading with depth to light yellowish-brown heavy fine sandy loam. Below about 15 inches is brownish-yellow friable sandy clay loam. Sandstone bedrock is at a depth of 24 to 40 inches. The 4- to 6-inch layer directly above the bedrock is splotched or mottled yellow, reddish brown, and gray, and is more sandy than the material above.

As mapped in Rhea County this soil is typical of the Hartsells series, but differs from some Hartsells soils mapped in northern Alabama in that it is shallower to bedrock and has a finer texture. The relief is undulating or gently rolling, and internal drainage is good.

The aggregate area of 4,224 acres is widely distributed over the smoother parts of the Cumberland Plateau ridges, and the largest areas are on the broader ridges. Some of the most extensive ones are in the vicinity of Ogden and Grandview. It is associated with the more sloping Hartsells, the Crossville, and the Muskingum soils.

About 60 percent is cleared (fig. 12, *A*). The forest on the remaining parts consists chiefly of oak, hickory, and a small quantity of Virginia, loblolly, and white pine. As in the deciduous forest on the other well-drained soils, chestnut trees were an important part of the cover until they were killed by blight. The cleared part is used chiefly

FIGURE 12.—*A*, Corn and lespedeza, 3 miles northwest of Dayton, on newly broken land on Hartsells soil; additional forested acreage suitable for crops is in the background. *B*, A field of Hartsells fine sandy loam, 4 miles northwest of Dayton, being disked for seeding fall oats following a good harvest of soybean hay. Lespedeza will be sown on this oat ground in the spring, and corn will follow the double-crop harvest of oat grain and lespedeza hay.

for corn, small grain, soybeans, lespedeza, and redtop hay (fig. 12, *B*), and truck crops as potatoes, sweetpotatoes, beans, tomatoes, and strawberries (fig. 13, *A*). Yields under the most common level of management are fair; corn yields 20 to 30 bushels to the acre, oats about 18 bushels, and lespedeza ½ to 1 ton. Field crops are not fertilized, except corn, which generally receives light applications at the time of planting. Most truck crops are given at least moderate ap-

plications. Potatoes generally yield about 90 bushels an acre, but farmers who practice good soil management obtain about 200 bushels. They are of exceptionally good quality compared to those grown on soils of the Valley and Ridge province. Fruit trees are also planted on these soils (fig. 13, *B*). Sorghum for sirup is also of superior quality (fig. 14, *A*).

This soil is of low natural fertility, but when properly managed and fertilized it is suited to a great many of the crops commonly grown in this section. Its workability is good, and control of runoff is not difficult.

Hartsells fine sandy loam, rolling phase.—This phase has a more rolling relief than the typical soil. In general there are very few

FIGURE 13.—*A*, Hartsells soils, 4 miles northwest of Dayton, well suited to potatoes, sweetpotatoes, beans, carrots, tomatoes, and other truck crops. These products in the vicinity of Ogden are grown for the late summer Chattanooga market. *B*, A few apple trees are common to many farms on the Hartsells soils, and a very few small young commercial orchards are being given better than average care. View 4½ miles west of Dayton.

outcrops of bedrock. The slope ranges from 5 to 9 percent, and internal drainage is good.

The aggregate area of 16,768 acres is widely distributed throughout the smoother parts of the Cumberland Plateau. The areas are fairly large and are associated with the other Hartsells and with the Muskingum soils. On the broader ridges they lie on the gentle slopes adjacent to areas of the typical soil, but on the narrower ridges they occupy the entire ridge tops.

A considerable part of the soil is still in oak and hickory forest, especially those areas on the narrower ridge tops closely associated with extensive areas of the steep Muskingum soils. The cropped areas are used for general farm and truck crops, and it is probable that a greater part is used for meadow or pasture. If the productivity is to be maintained at a fairly high level, regular liming and fertilization must be practiced and care must be given to control the water on the land.

Hartsells fine sandy loam, eroded rolling phase.—The rolling relief has lost 50 to 75 percent of the original surface layer. The subsoil is exposed in places, and the plow layer over most of the acreage includes some subsoil material. The relief is rolling, the gradient ranging from 5 to 9 percent.

The aggregate area is 1,984 acres. All the soil has been tilled, and most of it is now used for crops. Most of the areas are associated with moderate to large areas of other Hartsells soils of the Cumberland Plateau.

The soil is used like other Hartsells soils. The acreage of truck crops may be lower and that of hay and pasture a little higher. Yields may be expected to be a little lower because of the eroded condition and the diminished supply of plant nutrients. Particular care needs to be given this soil to prevent further damage from runoff and to build up the fertility. The surface should be protected as much of the time as possible by a good vegetative cover including winter cover crops, and the fertility increased by manure and fertilizers, especially phosphate and lime.

Hector fine sandy loam, eroded phase.[9]—A few areas have lost all of their surface layer, and in these areas there are some gullies. Below this is brown to reddish-brown heavy fine sandy loam that is redder with depth. At about 18 inches below the surface is red firm but friable sandy clay loam. Sandstone bedrock lies at a depth of 30 to 50 inches. Directly above the bedrock is a 4- to 6-inch layer of profusely splotched brownish-red, yellow, rust-brown, and gray brittle but friable sandy clay loam. There are some sandstone fragments, especially in the lower part. The relief is hilly, the gradient ranging from 9 to 30 percent. Internal drainage is good, but external drainage is excessive.

The aggregate area is 640 acres, and practically all of it is along the lower slope of the Cumberland escarpment and on low ridges directly to the southeast of the escarpment. Some of the larger areas are in the vicinity of Roddy.

All of this soil has been cleared and cropped at some time, and most of it is now being tilled. Corn, small grains, and lespedeza and red-

[9] See footnote 8, p. 46.

top hay are the chief crops. Fertilization is not practiced regularly, consequently yields are low.

Because of its low fertility and hilly relief it is difficult to work and conserve. For this reason, it is poorly suited to crops that require tillage, or to pasture. Shortleaf pine establishes itself easily and produces a good stand. If this soil is needed for pasture, fairly good grazing can be maintained by proper liming, fertilization, and seeding. Care is necessary to avoid erosion even when it is used for pasture unless an exceptionally good sod is established. Where the soil is required for crops, a long rotation comprised of close-growing small grains and hay is most desirable. Tillage should be avoided as much as possible, and a good vegetative cover should be maintained throughout the year. Comparatively heavy fertilization is required to maintain a good cover and moderately high yields.

Hector stony fine sandy loam.—This soil has a shallow depth to bedrock, and a sufficient quantity of sandstone fragments is on and throughout the soil mass to interfere materially with tillage. About half the area has been eroded, and a part of this is severely eroded. The eroded part represents that which has been cleared and tilled; the uneroded chiefly that which has remained in forest. The relief is hilly to steep, and the gradient ranges from 9 to more than 30 percent.

The aggregate area is 1,408 acres. Most of it is on the lower part of the Cumberland escarpment or on low ridges directly southeast of the escarpment. Much of the cleared and eroded part is in the vicinity of Roddy.

This soil is poorly suited to crops requiring tillage. Its productivity is moderately low, and it is difficult to work and conserve. If it is to be used for pasture and properly conserved, it requires fertilization and seeding. Most areas are probably best used for forest.

Holston gravelly fine sandy loam.—The gravel on and in the plow layer is sufficiently abundant to interfere materially with tillage. The slope ranges from 5 to 12 percent. Much of the cleared area has lost a considerable part of the original surface layer by erosion. All areas are on high terraces or benches well above flood water, and none of them have a mottled yellow, brown, and gray condition above a depth of 28 or 30 inches. Internal drainage is good.

The 576 acres mapped is associated with other Holston soils and with soils of the Nolichucky series. The areas are small and widely distributed.

Much of this soil has been cleared, but some of it has been abandoned and is now covered by a weedy or brushy growth. That part still under cultivation is used for corn, small grains, lespedeza hay, and strawberries. The latter crop is more common to the gravelly type than to the very fine sandy loam. Crop yields average lower than on the very fine sandy loam, although strawberries when properly managed yield well.

This soil is not so well suited as Holston very fine sandy loam to crops requiring tillage, principally because of its more sloping relief and its gravelly character. The more gravelly areas have poorer moisture conditions and consequently dry out sooner during prolonged periods of drought. Under good management it is capable of producing fairly good yields, but particular care must be given

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to the maintenance of fertility and to control runoff. Because of its low fertility and more droughty nature its value as pasture is lower than that of many soils.

Holston very fine sandy loam.—This is a smooth yellowish fine sandy loam soil on moderate to high terrace lands. The 10- to 12-inch surface layer is yellowish-gray very fine sandy loam underlain by yellow firm but friable sandy clay that in some places is lightly mottled with brown. Below a depth of about 30 inches the material is mottled yellow, brown, and gray firm but friable sandy clay. This mottled layer, especially on the lower lying smoother areas, is a little nearer the surface in some places.

The relief is nearly level to undulating, the gradient seldom exceeding 5 percent. Internal drainage, although somewhat retarded, is sufficient for all crops commonly grown. Only a few areas on the lowest benches are subject to flooding, and these only by exceptionally high floods.

The 640 acres of this soil are widely distributed over parts of the county represented by the Talbott-Colbert-Waynesboro, Talbott-Allen-Lindside, and Huntington-Wolftever-Sequatchie soil associations. Some of the larger areas are near Roddy, southwest of Watts Bar Dam, and south of Yellow Creek Church. Most of the areas are a part of smooth to rolling landscapes and are generally associated with soils of the Waynesboro, Nolichucky, and Sequatchie series.

A large part of this soil has been cleared and is being tilled. Corn, wheat, soybeans, lespedeza and redtop hay, and some truck crops are among the crops grown. Crops are rotated, and some fertilization is practiced, but neither is done systematically. Average yields are fair. Corn yields about 25 bushels to the acre, wheat 8 to 12 bushels, and lespedeza and redtop hay about three-fourths of a ton under common management. Corn and wheat generally receive light to moderate applications of fertilizer. Tomatoes receive light applications of fertilizer, and yields are usually low. Under favorable conditions and good management the yields exceed 300 bushels.

The natural productivity is low, but under good management good yields of most crops may be expected. Organic matter, phosphorus, and lime are probably its chief requirements. The soil is easily worked, its moderately sandy texture and smooth surface being particularly favorable in this respect. The conservation of a high state of fertility requires special effort, but the control of excess water is not a serious problem. With proper fertilization and the use of legume cover crops this soil is well suited to a rotation of moderate length.

Huntington fine sandy loam.—This soil is similar to Huntington silt loam in color, drainage, and general position, but has a more sandy texture than the silt loam type. The 24-inch surface layer is brown mellow fine sandy loam. Below this the material may be more sandy, or it may grade to finer textured material. The reaction is slightly acid to neutral. The surface is nearly level, and internal drainage is good. Most areas lie as a very gently undulating strip several yards wide along the riverbank. They are generally a little higher than the other soils of the first bottoms, and during normal floods many areas lie as islands. These are covered by the larger

floods. The aggregate area of 960 acres is covered by the water of Watts Bar and Chickamauga Reservoirs.

Practically all of this soil has been cleared and cropped. Although its natural fertility is a little lower than that of Huntington silt loam, its slightly higher position makes it well suited to a wider variety of crops. Corn, wheat, soybeans, lespedeza, red clover, and alfalfa are among the more commonly grown general farm crops. Truck crops are not grown extensively. Fertilization is less common than on the soils of the upland.

This is one of the more desirable soils for crops. It is of moderate fertility, is easily worked and conserved, and is suited to a fairly wide variety of crops. It requires more effort to maintain a high state of fertility than Huntington silt loam and is not so productive of grasses and other common pasture plants. Some fertilization is necessary if high productivity is to be maintained under an intensive or short rotation system. This is particularly true since the partial stabilization of flow by a system of dams on the Tennessee River diminishes the volume and frequency of floods that have aided in the maintenance of the fertility of the first bottoms.

Huntington silt loam.—This soil is a well-drained productive soil of the first bottoms along the Tennessee River. To a depth of 3 feet or more the surface material is brown friable silt loam. The lower 18 to 24 inches is generally firmer than the upper part, but all of it is permeable and well drained. In some places below a depth of 3 feet the material is brown faintly mottled with gray and yellow silt loam or silty clay loam, although in others it is lighter brown and more sandy. The reaction ranges from slightly acid to slightly alkaline. All of it is on the first bottoms along the Tennessee River, and much of the total area of 1,024 acres has been covered by waters of Watts Bar and Chickamauga Reservoirs.

The relief is nearly level or gently undulating, and although surface drainage is slow, internal drainage is sufficient to maintain good drainage for all crops commonly grown except during floods. At such times, this soil is inundated or has its water table raised to near the surface.

Practically all of this soil has been cleared and cropped, and a large part has been used continuously for corn. Small quantities of hay and small grains have been grown, but the latter tend to grow rank and lodge. Yields of corn and hay are high and can be maintained easily. Under a system of continuous row crops corn yields from 40 to 60 bushels an acre. Hay, which is chiefly clovers, timothy, Johnson grass, or alfalfa, yields 2 to 4 tons to the acre. Pasture of excellent quality and high carrying capacity is easily maintained.

This is one of the most productive soils of the county. It is capable of producing large yields of such crops as corn for several consecutive years without fertilization. Small grains commonly lodge, and fall-sown crops are subject to damage by spring floods. The workability is good, and the maintenance of productivity and workability requires little effort.

Jefferson stony fine sandy loam.—This soil is more stony and, in most places, somewhat more sandy than Jefferson very fine sandy loam. The surface soil is generally fine sandy loam and the subsoil a

less firm sandy clay loam. Sandstone cobbles and fragments are sufficiently abundant to interfere materially with field operations and in some places practically to prohibit tillage. The relief is undulating or gently sloping, and internal drainage is good.

The aggregate area is 192 acres. Most of the areas are small and are commonly associated with other soils of the Jefferson series in that part of the county represented by the Jefferson-Clarksville-Upshur soil association.

Part of this soil has been cleared, but some of the cleared acreage is idle or used as unimproved pasture. The part that is cropped is used chiefly for corn, small grains, and lespedeza and redtop hay. Yields under common management are fair, but the pasture vegetation is poor.

Natural productivity is low, and workability is difficult, depending on the quantity and size of the stone. Conservation of fertility requires special effort, but control of runoff presents no serious problem. Under proper management the soil is capable of producing good yields of most crops commonly grown except where the stones are too abundant to permit tillage. Many of these areas can be improved as pasture land if properly seeded and fertilized.

Jefferson stony fine sandy loam, eroded sloping phase.—The relief is sloping, the gradient ranging from 5 to 12 percent, and sandstone cobbles and fragments are sufficiently abundant to interfere materially with field operations. Internal drainage is good. Some areas are so located as to benefit from seepage water from the adjacent higher lying soils.

The aggregate area is 576 acres. The soil is associated with the other Jefferson soils, and many areas are adjacent to Hanceville and Muskingum soils and lie at a lower elevation. Most of it is in that part represented by the Jefferson-Clarksville-Upshur soil association, but there is also a small quantity in the part represented by the Muskingum-Apison association.

All this soil has been formerly cleared and cropped, but part of it is idle or is used as unimproved pasture. Most of the tilled part is used for corn, lespedeza and redtop hay, and a small quantity for truck crops. Yields are fair and can be expected to respond well to improved management and fertilizer. Unimproved pasture is of poor quality and can likewise be greatly improved by proper management.

This soil is poorly suited to crops requiring tillage; it is of low productivity, is difficult to work, and its proper conservation presents problems of increased fertility and adequate runoff control. Many areas probably can be used best as forest land. Observations indicate that shortleaf pine does well on this soil.

Jefferson very fine sandy loam.—This is a well-drained friable yellowish soil developed from colluvial-alluvial material washed from Muskingum and Hartsells soils. The 8- to 14-inch surface layer is grayish-brown to brownish-gray fine sandy loam underlain by brownish-yellow firm but friable sandy clay. Below a depth of about 22 inches is mottled or splotched brownish-yellow, rust-brown, and gray brittle sandy clay. There are some sandstone fragments or gravel throughout the soil mass, but they are not sufficiently abundant to interfere materially with field operations.

The relief is undulating to gently sloping, the gradient seldom exceeds 5 percent. Internal drainage is good. The aggregate area is 1,408 acres. A large part of it is in the irregular valleys at and parallel to the foot of the Cumberland escarpment. These valleys are a part of that section represented by the Jefferson-Clarksville-Upshur soil association. A few areas are widely distributed throughout those parts represented by the Hartsells-Muskingum and Muskingum-Apison soil associations. Most of the areas are small, and many are associated with more sloping soils less well suited to agricultural use.

Much of this soil has been cleared and is cropped. Corn, small grains, and hay are the chief crops, but some vegetables and strawberries are produced as cash crops. Corn yields about 25 bushels to the acre, wheat 10 to 12 bushels, and lespedeza hay about three-fourths ton. Crops are rotated but with no specific regularity. Fertilization is generally light, and fertilizer is used chiefly on wheat and truck crops.

This soil is of low natural productivity, but it is easily worked, and runoff is not difficult to control. If it is to be conserved at a moderately high productivity, its fertility must be increased. When properly managed, it is suited to a wide variety of crops common to this section.

Jefferson very fine sandy loam, eroded sloping phase.—This soil has a sloping relief of 5 to 12 percent. It has lost 50 to 75 percent of the original surface soil, the subsoil is exposed in places, and the plow layer of most of it includes some subsoil material. Sandstone fragments are common but are not sufficiently abundant to interfere seriously with field operations. Internal drainage is good.

The aggregate area is 1,152 acres. Most areas are small and are commonly associatel with areas of other Jefferson soils and with the Muskingum series. This phase is in those parts of the county represented by the Jefferson-Clarksville-Upshur, Muskingum-Apison, and Hartsells-Muskingum soil associations.

All the land has been cleared and cultivated at some time, but part of it now lies idle or is used as unimproved permanent pasture. General farm crops, chief of which are corn, wheat, and lespedeza and redtop hay, predominate on the tilled part, although a small quantity of truck crops as beans and potatoes are also raised. Lower yields may be expected than those on the typical soil. A regular system of rotation is not commonly followed, and only light and irregular fertilization is practiced.

This soil is only fairly well suited to crops requiring tillage. It is of low productivity, is somewhat difficult to work because of its slope and eroded condition, and its conservability is fair to poor. If this soil is to be used for crops requiring tillage, long rotations consisting chiefly of close-growing small grains, hay, and pasture crops should be used; if such exacting crops as red clover and alfalfa are to be grown, liberal applications of phosphorus, lime, and organic matter will have to be made. The establishment of good-quality pasture will likewise require liberal fertilization as well as proper seeding and management.

Limestone outcrop.—This land type represents areas in which limestone outcrops are so abundant that the areas are of little or no value either for crops or for permanent pasture. Most of the very

limited parts of soil material are of shallow depth to bedrock and consequently dry out shortly after rains in the summertime. The relief varies from smooth to steep, the gradient ranging up to 60 percent or more. The greater part of it has a slope of 5 to 20 percent.

The 768 acres mapped are in small areas and are widely distributed throughout those parts represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. There are also a few areas in that part represented by the Fullerton-Clarksville association. Many of the areas are closely associated with the Colbert soils and rolling stony land (Colbert soil material).

A small part of this land type has been cleared, but most of it supports a variable growth of redcedar, redbud, hackberry, and certain other trees and shrubs. Black locusts have been planted in some places, and some fence-post material has been obtained from them and from redcedars. The land is considered of little or no value for crops or for pasture.

Lindside silt loam.—This fertile brown mellow intermediately drained soil is common to the first bottoms along the Tennessee River and creeks of the limestone valleys. The 10-inch surface layer is brown or grayish-brown mellow silt loam underlain by grayish-brown slightly mottled with gray, yellow, and rust-brown friable silt loam, which grades to firmer, finer textured, and more mottled material with depth. Below a depth of about 26 inches is highly mottled light-yellow, gray, and reddish-brown silty clay that is sticky when wet and hard when dry. The reaction for the most part is moderately to slightly acid.

The relief of this soil is nearly level or slightly concave, and many of the areas along the Tennessee River lie in slight depressions adjacent to or in areas of the better drained Huntington soils. Most areas accordingly are more subject to flooding than are the Huntington soils. Both surface and internal drainage are slow.

The aggregate area is 1,408 acres. The largest areas are on the first bottoms along the Tennessee River. There are also numerous areas along the creeks in those parts represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. The areas along the smaller creeks commonly occupy the entire strip of first-bottom land, whereas along the Tennessee River they occupy gentle depressions associated with the Huntington soils.

Practically all of the land has been cleared. Some of it, especially those parts severely cut by creek meanders, is used as permanent pasture. The rest is cropped, chiefly to corn, but some hay, especially red clover and timothy, is also grown. Corn yields about 40 bushels and red clover and timothy hay about 1½ tons to the acre. Very little fertilizer is used, and corn is commonly grown several years in succession.

It is a productive soil; it has fairly good workability and excellent conservability. Most areas are very fertile, but their productivity in some seasons is sharply reduced by untimely floods. Imperfect drainage is responsible for delayed field operations in the spring, and excessive moisture sometimes interferes with cultivation and harvesting. Fertility is easily maintained, and erosion is no hazard. The range of suitability for crops is limited. Small grains commonly lodge, and internal drainage is inadequate for alfalfa and the suc-

cessful growth of most truck crops. Many areas can be improved for agricultural use by artificial drainage, but the feasibility of such improvement will depend on the cost and the measure of this benefit over its usefulness in the undrained state.

Lindside silty clay loam.—This soil has a finer texture and a heavier consistence than the silt loam type. The surface layer is generally a little darker than that of Lindside silt loam, although not so dark as that of Dunning silty clay loam. The areas occupy nearly level or slightly depressed positions associated with Huntington soils. All of them are subject to flooding. Internal drainage is sufficient for corn, lespedeza, redtop, and timothy, and for most of the common pasture plants.

A large part of the 512 acres mapped is on the first bottoms along the Tennessee River, and practically all is cropped. Corn occupies a large part of the acreage, and some of it is used for hay. A small acreage is pastured. Yields approximate or are a little lower than those for the silt loam type, owing partly to the less favorable internal drainage. Volunteer pasture where weedy growth has been controlled is ordinarily of good quality and of high carrying capacity.

This is a very fertile soil, but its productivity is somewhat limited by its slow internal drainage and susceptibility to flooding—conditions that also limit its range of suitability for crops. Its workability is noticeably less favorable than that of the smooth friable well-drained soils of the uplands, chiefly because of the prolonged wet-soil conditions in the spring and after heavy rains, and because of the heavy consistence of the plow layer. Plant nutrients are easily maintained at a high level, and erosion is not a hazard. The productivity and range of suitability for most areas can be raised by artificial drainage, although factors other than those of the soil itself may make such improvement impractical.

Melvin silt loam.—This is a light-colored poorly drained soil common to the first bottoms along the Tennessee River and creeks of the limestone valleys. The 12-inch surface layer is brownish-gray faintly mottled with various shades of gray and brown mellow silt loam. Below this and to a depth of about 20 inches is mottled yellow, gray, and light-red silty clay loam to moderately plastic clay. The material below a depth of about 28 inches is gray mottled with yellow and light-red plastic clay that is grayer with depth. Some areas, especially those in the vicinity of areas of Clarksville and Fullerton soils, have some chert in them. The reaction of most areas is acid.

The relief is nearly level, and many areas are in slight depressions associated with the better drained soils of the first bottoms. Practically all areas are subject to periodic floods and are the first areas of the bottom lands to be inundated. The soil is moist, except during the very driest periods, and much of the time the water table is near the surface.

The aggregate area is 1,600 acres. Most of the areas are in that part represented by the Talbott-Allen-Lindside soil association, and a few areas are in those parts represented by the Huntington-Wolftever-Sequatchie and Talbott-Colbert-Waynesboro soil associations. Much of the acreage represented by the Talbott-Allen-Lindside association is along the smaller creeks and occupies a considerable part of the first-bottom land.

Approximately half of the land has been cleared, but only a small part is tilled, the greater part of the cleared acreage being used for permanent pasture. The uncleared acreage is occupied chiefly by deciduous forest, which, for the most part, is not merchantable. Corn and such hay crops as timothy, lespedeza, and redtop are the principal crops. Yields of these vary considerably. They are relatively high during dry seasons and low during seasons of excessive rain. Although its suitability for crops requiring tillage is limited, it is a very desirable soil for pasture. Native permanent pasture, where weedy growth is suppressed, includes a large quantity of bluegrass and white clover, except on the wettest areas. This kind of pasture land affords considerable grazing of good quality and is of especial value, inasmuch as it generally supports a green vegetative cover longer during the dry periods than the higher better drained soils.

The productivity and range of suitability of many areas for crops requiring tillage can be raised by artificial drainage, but the feasibility of such improvement will depend on several factors other than those of the soil. In general, most areas in their undrained condition are of high value as permanent pasture (fig. 14, *B*).

Mines, pits, and dumps.—This miscellaneous land type represents areas that have been widely distributed either by excavation or dumping or both. Most of the pits are either gravel or clay and most of the dumps are from coal mines. The material of these areas is so mixed and rough as to be of little or no agricultural value. Where feasible these areas probably should be afforded a vegetative cover of kudzu or suitable forest.

The aggregate area is 128 acres. Most of the areas are small. The coal mine dumps are widely scattered throughout the steeper parts of the Cumberland Plateau and the greater part of them are on the Cumberland escarpment. The largest clay pit occupies about 30 acres three-fourths of a mile northeast of Graysville. Clay from this pit is used for making tile.

Montevallo silt loam, hilly phase.[10]—This grayish silty shallow soil over acid shale is common to a few of the shale hills of the eastern part of the county. The 8- to 10-inch surface layer is yellowish-gray friable silt loam. There are a few small sandy shale fragments throughout this layer in some places, and much of the surface layer on those areas that have been cleared has been lost as a result of erosion. The subsoil, which is commonly absent, is yellowish-brown firm but moderately friable clay loam or silty clay loam that may be 10 inches thick. Soft shale fragments are abundant in the lower part, and bedrock of variegated purple, brown, yellow, and gray soft acid shale is generally at a depth of less than 20 inches. The depth to bedrock is shallower in many places.

The relief is hilly; the gradient ranging from 12 to 30 percent. Internal drainage is good through the soil material, but the shallow depth to the less pervious bedrock limits the ability of the soil to absorb moisture. Accordingly, it dries out soon after rains and when cleared is subject to a relatively heavy runoff.

Nearly all of the 768 acres mapped is on one ridge southeast of New Bethel Church near the Tennessee River. A small part has been

[10] See footnote 8, p. 46.

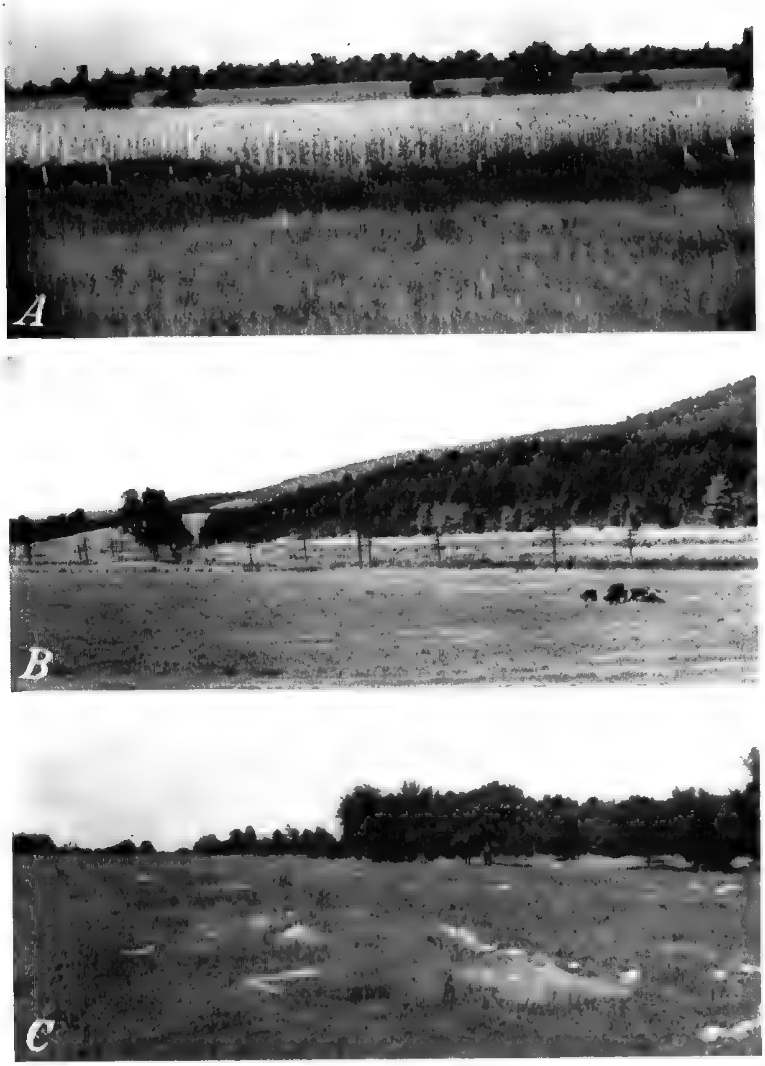

FIGURE 14.—*A*, Sorghum grown for sirup on Hartsells soils both for household use and for nearby markets is of very good quality. View 4½ miles west of Dayton. *B*, Young beef cattle grazing permanent pasture on Melvin silt loam, 1¾ miles southwest of Roddy. Chiefly as a result of suppressing the weeds and brushy growth, a good stand of bluegrass and white clover has been established on the less wet parts; sedges and redtop predominate on the wetter parts. *C*, Area 1 mile southwest of Carp School, south of Spring City, of rolling stony land (Colbert soil material), which is commonly associated with the Talbott and Colbert soils and is poorly suited to crops requiring tillage because of the shallow depth to rock and the frequent rock outcrops.

cleared, but most of this has been abandoned and now has a young growth of shortleaf pine on it. The forest on the uncleared part is chiefly oaks and other deciduous hardwoods intermixed with some pine.

This soil is poorly suited to either crops requiring tillage or pasture. It is of low productivity, is difficult to work, and is very difficult to conserve when tilled. Trees, especially pine, do fairly well. An appreciable quantity of telephone poles and small sawlogs has been obtained from tracts of reestablished pine forest on the areas that had been abandoned after cropping.

Muskingum stony fine sandy loam.—This stony, sandy soil has steep slopes and shallow depth to sandstone bedrock. The surface layer is brownish-gray fine sandy loam, most of which contains numerous sandstone fragments. It varies in thickness and seldom exceeds 5 inches. The underlying soil material is brownish-yellow friable fine sandy loam to sandy clay loam containing numerous sandstone fragments. Sandstone bedrock lies at a variable depth but is seldom more than 18 inches below the surface. Bedrock outcrops are common, and there is an abundance of loose sandstone fragments on the surface. The reaction throughout its entire depth is strongly to very strongly acid.

A limited quantity of this soil is developed over purplish fine-grained sandstone. The surface layer is purplish-brown very fine sandy loam, and the subsoil is light purplish-brown fine sandy loam or sandy clay loam. Fine-grained purplish sandstone bedrock lies at a shallow depth. This inclusion has been called Lehew very fine sandy loam in other areas, but because of its limited area and its similarity in several physical characteristics it has been included with Muskingum stony fine sandy loam.

The relief is steep; the gradient being more than 30 percent. Areas that are cleared have very rapid runoff, and the water-holding capacity of the soil material is small.

A large part of the 11,328 acres mapped is associated with rough stony land (Muskingum soil material) and is chiefly in that part represented by the Muskingum-rough stony land soil association. Some areas occupy the steeper slopes along the drains, where they extend into that part represented by the Hartsells-Muskingum soil association. The purplish variation is confined to a relatively small acreage on some of the sandstone and shale ridges in that part represented by the Muskingum-Apison soil association.

Only a small acreage has been cleared and cropped, and most of this either lies idle or has a stand of shortleaf pine established on it. A deciduous hardwood forest of oak and hickory with some pine intermixed predominates on the acreage that has not been cleared.

This soil is very poorly suited to tillage and pasture. It is of low productivity, is difficult to work, and is very difficult to conserve. It can best be used as forest land in most places.

Muskingum stony fine sandy loam, eroded hilly phase.—The hilly relief has lost more than half of its original surface layer. In some places, all the surface soil and a part of the underlying soil material have been lost.

The aggregate area is 1,984 acres, which is a small part of the total area of the hilly Muskingum stony fine sandy loam soils. It is widely distributed throughout those parts of the county where the other Muskingum soils are, but a considerable part of it is associated with the Hartsells soils of the Hartsells-Muskingum soil association.

All this soil has been cleared and cultivated at some time. A small part is now used for crops requiring tillage, much of it is used for pasture, and a small quantity has been abandoned and is now occupied by either a brushy growth or by shortleaf pine. The suitability for agriculture approximates that of the uneroded hilly phase. Many areas, however, are so badly eroded that they are of little or no value as pasture, and other areas require considerable effort to make them productive. Where farm requirements do not necessitate the use of this land for pasture, it probably can best be utilized as forest land.

Muskingum stony fine sandy loam, hilly phase.—This hilly phase differs from the typical soil in that it has hilly rather than steep relief. The slope ranges from 9 to 30 percent. The moisture-holding capacity is low, and runoff is very rapid on cleared areas. Tilled areas are subject to erosion.

The aggregate area is 31,104 acres. It is widely distributed throughout those areas represented by the Hartsells-Muskingum and Muskingum-rough stony land soil associations, and a large part of it is along the upper ends of the creeks and drains where they extend into the higher, smoother parts of the Cumberland Plateau. In these areas, this soil is associated with Muskingum stony fine sandy loam, rolling phase, and the Hartsells and Crossville soils. In the rougher parts of the plateau, they are associated with the normal steeper Muskingum type and rough stony land (Muskingum soil material). A small acreage is associated with Muskingum stony fine sandy loam in those parts of the county represented by the Muskingum-Apison soil association, and in these areas most of the hilly phase occupies the less steep ridge tops and uppermost parts of the slopes.

Very little of this soil is cleared, and, except under unusual circumstances, its best use is as forest land. Where good pasture is scarce, as on the plateau, certain areas may be used to advantage for this purpose. Substantial fertilization, especially with phosphorus, and applications of lime and manure are of great value in establishing pasture on this land. Lespedeza, redtop, ryegrass, and fall-sown small grains are among the more easily established pasture crops, and more exacting grasses and legumes may be used if a high state of fertility is attained. Owing to the low water-holding capacity, unfavorable moisture relations limit the usefulness for pasture even though a high state of fertility is established and runoff is controlled. Most pastures dry out at an early date during dry periods, especially on the south-facing slopes.

Muskingum stony fine sandy loam, rolling phase.—This soil differs from the normal type in that it has a smooth to rolling, rather than a steep relief. It is a little less stony, rock outcrops are less numerous, and there is more soil material over bedrock. It has a rather shallow depth to bedrock and some loose sandstone fragments and bedrock outcrop. Although most areas have a brownish-gray stony fine sandy loam surface layer about 5 inches thick underlain by brownish-yellow friable fine sandy loam or sandy clay loam, a few areas have a browner color resembling the Crossville soils. The depth to bedrock seldom exceeds 18 inches.

The relief is smooth to rolling; the gradient seldom exceeding 9 percent. Internal drainage is good, but owing to the sandy nature and shallow depth to bedrock, the moisture-holding capacity is small.

The aggregate area is 11,200 acres. A large part of it is associated with the Hartsells soils of the Hartsells-Muskingum soil association and accordingly lies on the smoother parts of the Cumberland Plateau. A part of it has been cleared and is used for corn, lespedeza and redtop hay, and pasture. Crop yields are only fair. Crops commonly suffer from lack of moisture.

This soil is poorly suited to crops requiring tillage, mainly because of its low water-holding capacity, low natural fertility, and moderately difficult workability, which is caused by the shallow depth to bedrock. Much of it can be used to advantage as pasture, but its value as such is limited, because of its droughty nature. Proper fertilization and seeding improve its carrying capacity considerably. As with other Muskingum soils used for pasture or crops, particular care must be taken to conserve it from losses by erosion, because a relatively small loss results in a very considerable reduction in its suitability for these purposes. Areas not urgently needed for pasture and crops can be used best as forest land.

Nolichucky fine sandy loam.—This smooth grayish sandy soil has a light-red subsoil developed on some of the higher benches or terraces. The 8-inch surface layer is gray fine sandy loam underlain by yellow friable fine sandy loam that becomes finer textured with depth. About 16 inches below the surface is reddish-yellow or light brownish-red firm brittle sandy clay. The color is lighter below a depth of about 36 inches and with increased depth is mottled or variegated red, yellow, and gray. The material of this lower layer is firm brittle sandy clay. Irregular gravelly beds are common in some places at a depth of 4 to 8 feet, and a great many areas have a small quantity of gravel distributed throughout the soil mass. More than one-third of the total area has sufficient gravel in it to interfere materially with field operations. The soil is strongly acid. The relief is undulating; the gradient ranging from 1 to about 5 percent. Internal drainage is good.

The aggregate area is 128 acres. The areas are not large and are rather widely distributed over the area of the county represented by the Talbott-Colbert-Waynesboro soil association. Practically all of it has been cleared, but some of it lies idle and is covered by a brushy growth of sassafras, persimmon, broomsedge, and briers. Corn, wheat, oats, and lespedeza and redtop hay are the more common general farm crops, and some tomatoes and strawberries are grown as cash crops. Yields of general farm crops under common management practices are fair. Corn generally yields about 25 bushels an acre, wheat 8 to 10 bushels, and lespedeza hay about three-fourths ton. Crops are rotated but not systematically; only small quantities of fertilizer are used, and most of this for wheat. The yields of tomatoes and strawberries are usually low—strawberries 30 to 50 crates an acre, but good yields of both crops can be obtained under good management. They are mostly grown on newly cleared ground and are generally not fertilized heavily. Yields of all crops on the more gravelly areas average lower than do those on the less gravelly ones, which are lower in plant nutrients and generally are more droughty.

The soil is of low natural productivity. The less gravelly areas are easy to work, but the more gravelly ones are difficult and are not well suited to crops requiring tillage. The conservability of plant

nutrients is moderately difficult, but the control of runoff is not a serious problem. This soil is fairly well suited to crops requiring tillage, but if good yields are to be obtained most areas will need to have their fertility substantially increased. Good pastures can be established with proper fertilization and seeding, although they are not so productive as those on some of the finer textured more fertile soils.

Nolichucky fine sandy loam, eroded sloping phase.—This soil has lost more than half the original surface layer. The subsoil is exposed in many places, and there are a few gullies, especially on areas that have been abandoned or have lain idle for a few years. The quantity of gravel varies widely. In some places it is so abundant that tillage operations are impractical.

Internal drainage is good, and surface drainage is rapid enough to cause serious erosion unless proper measures for controlling runoff are used. The gradient ranges from 5 to 12 percent.

The aggregate area of 448 acres is widely distributed over that part of the county represented by the Talbott-Colbert-Waynesboro soil association and is associated chiefly with areas of the typical soil. Practically all of it has been cleared and cropped, but a considerable acreage now lies idle and is covered by a brushy growth of sassafras, persimmon, broomsedge, and briers. The cropped areas are used chiefly for corn, small grains, and lespedeza and redtop hay, and a small quantity of tomatoes and strawberries are grown as cash crops. Yields are lower than on the normal type, and the soil is less well suited to crops requiring tillage. It is more difficult to work, and conservation problems are greater.

Ooltewah fine sandy loam.—The 8- to 15-inch surface layer is light-brown fine sandy loam, which grades into mottled yellow, brown, and gray sandy clay loam or silty clay loam. The relief is nearly level. Surface drainage is poor, but internal drainage, although imperfect, is sufficient to make the soil suitable for such crops as corn and sorghum, and for certain hay crops. Temporary flooding is common during periods of heavy precipitation.

The aggregate area is 64 acres. Most of the areas are small and widely distributed throughout that part represented by the Talbott-Colbert-Waynesboro and Talbott-Allen-Lindside soil associations. The soils are generally associated with those that are more sandy than those with which the silt loam type is associated.

Practically all of this soil is cleared and cultivated. Corn and hay crops occupy most of it. Crop yields are lower than those obtained on the silt loam type, chiefly because of the low natural fertility. Corn under common management yields about 30 bushels and lespedeza hay from ¾ to 1 ton an acre. Tomatoes may be expected to give good returns if well managed, although the crop may be damaged by temporary flooding or excessively wet conditions during the wetter seasons.

Ooltewah fine sandy loam is moderately productive. It is not difficult to work except during the wettest periods, and the soil material is easily conserved. Its moderately low fertility, however, requires some effort if a high productivity is to be maintained.

Ooltewah silt loam.—This brown friable imperfectly drained soil occupying depressions or sinkholes that overlie limestone is composed of local alluvium washed from the surrounding soils, which for the most part overlie limestone. The surface layer to a depth of about 10 inches is brown or grayish-brown friable silt loam. Below this material the color is more nearly yellowish-brown, and small brown concretions are commonly present. To a depth of 12 to 18 inches is brownish-yellow mottled with gray, brown, and light-red moderately friable silty clay loam. Mottlings increase with depth, and below 24 inches gray predominates. The reaction of the soil material is medium acid.

The relief of this soil is nearly level. Surface drainage is very slow, inasmuch as surface outlets are not well developed and many areas in sinkholes have no surface drainage outlets. Internal drainage is slow but is sufficient to maintain satisfactory drainage conditions for such crops as corn, sorghum, and certain hay and pasture crops. Owing to the lack of good surface drainage outlets, areas are commonly ponded or flooded temporarily after periods of heavy precipitation.

The aggregate area is 1,600 acres. Very few of the areas occupy more than 5 to 6 acres. They are widely distributed throughout those parts represented by the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations, and there are a few areas in that part represented by the Fullerton-Clarksville association.

Practically all of this soil is cleared, and most of it is used for corn, sorghum for silage, and certain hay crops. Corn is the principal crop. Crop yields, except when damaged by excess moisture, are high.

This soil is well suited to crops requiring tillage. Its range of suitability, however, is somewhat limited by its imperfect drainage and high fertility. Alfalfa is easily damaged by the excess moisture, and small grains generally grow so rank that they lodge badly. The natural productivity is high, and little fertilization is required. The workability is good, although field operations are commonly delayed by wet conditions in the spring and after heavy rains during the growing season. The conservability is very good. The high natural state of fertility is easily maintained, and erosion is very seldom a hazard. This is a good soil for pasture, because of its high natural fertility and favorable moisture conditions that allow pasture vegetation to grow well into or through the late summer and fall dry period. This soil is well suited to late vegetables, although they are not now commonly grown on it.

Philo fine sandy loam.—This sandy imperfectly drained soil of the first bottoms of creeks has been washed from soils overlying sandstones and shales. The 10- to 12-inch surface layer is brown or dark-brown fine sandy loam. Below this is yellowish-brown material that ranges in texture from fine sandy loam to silt loam and may be faintly mottled with gray. Below about 20 inches is mottled yellow, brown, and gray material that ranges in texture from silt loam to loamy fine sand. This soil is strongly acid throughout. The relief is nearly level, and internal drainage is slow. Practically all of the soil is subject to periodic overflow which sometimes damages the crops.

The aggregate area of 2,368 acres lies southeast of the Cumberland escarpment along the larger streams that rise on the Cumberland Plateau. Much of it has been cleared and is now used for corn, hay, and pasture. Owing to the low natural fertility and imperfect drainage crop yields are only fair under common management. Hay and pasture crops are of only fair quality, but with proper fertilization both yields and quality can be improved greatly, and late vegetables can also be grown successfully. The number of crops to which Philo fine sandy loam is well suited can be increased by artificial drainage, but the practicability of such improvement depends on several factors besides those of the physical nature of the soil.

Philo silt loam.—The surface layer is grayish-brown silt loam underlain by more yellowish firm silt loam that may be faintly mottled with gray and brown at a depth of about 7 inches. Below a depth of about 18 inches the material is commonly mottled gray and yellow silt loam. The relief is nearly level, and internal drainage is slow. Practically all areas are subject to periodic flooding.

Most of the 384 acres mapped is on the first bottoms along the creeks that rise on the Cumberland Plateau. One of the largest areas is along Brush Creek west of Ogden.

Much of this soil has been cleared and is used for corn, hay, and pasture. Because of the low natural fertility and imperfect drainage, yields are only fair. With proper fertilization good yields of crops as late vegetables, corn, sorghum, some small grains, soybeans, lespedeza, redtop, and orchard grass, as well as of some clovers, can be obtained. This soil should be of particular value as pasture land, provided it is properly fertilized and seeded. Its moisture conditions are more favorable for late summer pastures than are those of the well-drained soils of the associated upland. The suitability can be increased by artificial drainage, but whether such improvement would be profitable depends on several factors other than the soil.

Pope fine sandy loam.—This well-drained acid soil of the first bottoms is derived from alluvial materials washed mainly from soils underlain by sandstone and shale. Pope fine sandy loam differs from Huntington fine sandy loam in being strongly acid, lighter in color and lower in content of plant nutrients and organic matter. It differs from Philo and Atkins soils, which are derived from similar materials, in characteristics arising from better internal drainage. The profile is that of a young soil and varies in character and arrangement of layers from place to place. In cultivated fields the 6-inch surface layer is commonly brown to dark-brown mellow fine sandy loam. It is generally underlain by about 18 inches of material similar in color and texture, but slightly more firm in place than the material above. Below 24 inches the color varies from dark brown to yellow and the texture from loamy fine sand to fine sandy clay from place to place. For the most part it is slightly mottled with yellow, brown, and gray below 48 inches.

The soil is well suited to crops that require tillage. The almost level relief and physical condition of the surface layer favor easy tillage and maintenance of good tilth. External drainage is slow, but internal drainage is moderate, and, although the soil is subject to flooding during periods of high rainfall, the crops commonly

grown are rarely injured by excessive moisture. The soil is strongly acid throughout, and most crops respond to applications of lime. The content of nitrogen, phosphorus, and potash are generally less than in Huntington fine sandy loam. The problem of water control is insignificant except during floods, which occur mainly in spring and occasionally do some damage by scouring. The soil generally receives deposition of fresh alluvial materials during these floods.

The aggregate area of 1,088 acres mapped is mainly near some of the larger streams that head on the Cumberland Plateau or on the sandy ridges. Its areas are generally on high stream banks associated with areas of Philo, Atkins, and other Pope soils on the first bottoms, and the adjacent terraces are most commonly soils of the Sequatchie, Holston, and Tyler series.

Almost all of this soil is cleared, and most of it is used for crops that require tillage. Corn and hay are the principal crops, but vegetables are grown with success on some areas. Corn or other intertilled crops are grown continuously for several years, and a crop of lespedeza and grass is planted at relatively long intervals. Some farmers use the soil mainly for corn and an occasional crop of small grain. Very little fertilizer is used except for vegetable crops, which usually receive moderate to light applications of complete commercial fertilizer. Some manure or commercial fertilizer is generally used for corn at rather long intervals. Corn yields about 30 bushels and lespedeza hay about 1 ton an acre. Vegetables produce well. Very good yields of snap beans grown with corn are obtained by some farmers.

One of the main management requirements is maintenance of plant nutrients. Most crops respond well to lime, phosphorus, and nitrogen, and it is probable that they would respond to potash. Vegetables that can be planted after spring floods are especially responsive to heavy applications of complete fertilizers. The soil is easy to till and to maintain good tilth.

Pope loamy fine sand.—This is an almost level excessively drained light-colored acid soil of the first bottoms. The aggregate area of 320 acres is mapped mainly along small streams that rise on the Cumberland Plateau and consists of recent alluvium that was washed mainly from soils underlain by sandstone. It is associated mainly with Philo, Atkins, other Pope soils, and Sequatchie loamy fine sand.

The soil is lighter colored and more sandy than Pope fine sandy loam. It is generally light grayish-yellow loose loamy fine sand to a depth of about 3 feet, below which it is mottled with brown and gray. In some places sandstone fragments are on the surface and in the soil.

Almost all the soil has been cleared, but considerable acreage is idle at the present time. Some areas are used for corn or early vegetables and some for unimproved permanent pasture. A few areas have stands of poor to fair pine timber. Yields of corn and vegetables are commonly low. The soil is droughty and low in most plant nutrients and in organic matter. If it exists in places where moisture can be maintained at levels suitable for crop production, the soil can be made to produce moderately well under rather intensive management that includes heavy fertilization. Applications of lime, phosphorus, potash, and nitrogen are generally neces-

sary for good yields. Nitrogen may be maintained by the use of manure or leguminous green manure. Manure also supplies potash. Pastures are generally poor, and it is difficult to maintain good ones under the best feasible management because of the poor moisture conditions. Although relatively poorly suited both to crops that require tillage and to permanent pasture in most places, this soil has been included with the group of fourth-class soils.

Pope silt loam.—This well-drained acid soil of the first bottoms is derived from recently deposited alluvial materials washed mainly from soils underlain by sandstone and shale. It is influenced by material washed from shales.

Pope silt loam is slightly heavier textured throughout the profile than Pope fine sandy loam. It differs from Philo and Atkins soils, derived from similar materials, in characteristics arising from better internal drainage. The profile is that of a young soil, and varies in character and arrangement of layers from place to place. The 8-inch surface layer in cultivated fields is commonly brown mellow silt loam underlain by a lighter brown or brownish-yellow moderately heavy silt loam. This material is mottled with light brown and gray below a depth of 30 to 35 inches and generally contains layers of sandy or gravelly material at varying depths.

This soil is well suited to crops that require tillage. It is almost level, and the physical condition of the surface layer favors easy tillage and maintenance of good tilth. External drainage is slow, but internal drainage is adequate for most crops commonly grown. Although the soil is subject to flooding during periods of high rainfall, the crops generally grown are rarely injured by excessive moisture. The soil is strongly acid throughout the profile, and most crops respond to applications of lime. The content of nitrogen, phosphorus, and potash, as well as of lime, is generally less than for Huntington silt loam. The problem of water control is slight except during floods, which occur mainly in spring and may do some damage by scouring. The soil commonly receives deposition of fresh material during these floods.

The aggregate area of 640 acres is mapped mainly along streams that rise on the Cumberland Plateau or on the sandy ridges in the eastern part of the county. Almost all of it is cleared and is used for crops that require tillage. Corn and hay are the crops most commonly planted, but small grains or vegetables are grown by some farmers. Corn is generally grown continuously for several years and receives whatever manure is available and occasional light applications of superphosphate or of low-analysis mixed fertilizer. Lime is seldom used. Hay crops, as lespedeza and grass, are commonly grown after corn at relatively long intervals. Some farmers use small grains at long intervals between the corn and hay crops. Under the more common management, corn produces about 35 bushels and lespedeza hay about 1 ton to the acre.

One of the main management requirements is for maintenance of plant nutrients. Most crops commonly grown respond well to applications of lime, phosphorus, and nitrogen, and it is probable that in many places they will respond to applications of potash. The soil is easy to till and to maintain in good tilth. There is no serious

problem of control of runoff, but there is a problem of maintenance of plant nutrients.

Roane gravelly silt loam.—This is a moderately well-drained soil of the narrow first-bottom lands along intermittent streams that flow through areas of soils derived from cherty dolomitic limestone. The 3,200 acres of this soil occupy long narrow almost level first bottoms in the typically hilly landscape of the Clarksville-Fullerton soil association.

This soil is characterized by the presence of a layer of tightly embedded chert fragments at some place in the profile. The soil is young, and the character and arrangement of the layers vary from place to place. The 6- to 12-inch surface layer is commonly grayish-brown or yellowish-brown loose friable cherty silt loam underlain by a mixture of chert sand and silt that is friable to slightly sticky when wet but is slightly cemented and hard when dry. The character of this layer varies from place to place and may be as much as 25 to 30 inches below the surface. It is generally underlain by gray or bluish-gray cherty silt loam mottled with yellow and brown. The soil is medium to strongly acid.

The relief is almost level and the soil is moderately well drained internally. It is subject to flooding during heavy rains but the floods last for only short periods. Some seepage water is generally in the subsoil for considerable periods when the higher lying land adjacent to these areas is full of moisture. The soil is only moderately well supplied with plant nutrients, but it is fairly well suited to a large number of crops under good management. It commonly exists in areas in which the adjacent upland is rolling to steep Clarksville or Fullerton soils and is generally much better suited to intertilled crops, is more fertile than the adjacent soils, and is more easily tilled than are most other soils of the farms on which it exists. For these reasons, it is a very important soil on many farms of the Clarksville-Fullerton soil association.

The land is cropped continuously to corn or other intertilled crops. Hay, small grain, and, in a few places, vegetables and strawberries are also grown. Hay and small grain are generally inserted in a rotation with corn for short periods at relatively long intervals. Corn and hay are seldom fertilized, but corn receives most of the manure available on the farms. Vegetables and strawberries are commonly fertilized with moderately heavy applications of complete fertilizers. Under the more common level of management, corn produces about 18 bushels to the acre, wheat about 8 bushels, and strawberries about 35 crates.

This soil can be conserved in a short rotation that includes intertilled crops a large part of the time, and the major management requirements of such a rotation are the maintenance of plant nutrients and organic matter. Most of the crops commonly grown respond well to applications of lime and phosphorus. Nitrogen needs constant attention for maintenance, and crops may respond to potash in some areas. Roane gravelly silt loam is fair to good cropland and considered a Second-class soil.

Roane silt loam.—This is a fairly well-drained soil of the narrow, almost level first-bottom lands along intermittent streams that flow through in the typically hilly landscape of the Clarksville-Fullerton

soil association. Its aggregate area is 640 acres. The soil is easily distinguished from other soils of the bottom lands by the presence of a tightly embedded layer of chert. The character of the materials and the arrangement of soil layers vary from place to place. The topmost 6 inches ranges from brown to brownish-gray friable silt loam and is commonly underlain by yellowish-brown to brownish-yellow silt loam or silty clay loam. A tightly embedded layer of chert fragments mixed with soil material generally exists about 12 to 30 inches below the surface and may be as much as 15 or as little as 4 or 5 inches thick. Below this layer the material is commonly mottled with gray, yellow, and brown cherty silty clay loam. Small areas of soils of similar characteristics but lacking the layer of chert fragments have been included in the mapping unit.

The relief is almost level, and the soil is moderately well drained internally. It is flooded rather infrequently and for short periods when heavy rains fall on the drainage area. Runoff is fairly rapid, and these floods generally do little damage, although in some places they may scour or cause silting. The soil is strongly acid and only moderately fertile. Some areas of it may be droughty, but it is moderately well suited to a large number of crops and commonly exists in areas in which the adjacent upland is rolling to steep Clarksville or Fullerton soils. It is generally much better suited to intertilled crops, is more fertile, and is much more easily tilled than are other soils of farms on which it exists. It is, therefore, a very important soil on many farms of the Clarksville-Fullerton soil association.

Roane silt loam is generally cropped to corn or other intertilled crops for several years and is followed by a small grain and a hay crop on some farms. It is seldom fertilized for any of the crops commonly grown, but much of the available manure, which is commonly scarce, is spread on it. Corn generally produces about 35 bushels an acre, wheat about 12 bushels, and lespedeza hay about 1 ton.

The soil is well suited to a short rotation that includes intertilled crops a large part of the time, and the major management requirement of such a rotation is the maintenance of the content of plant nutrients and organic matter. Most of the crops commonly grown respond well to applications of lime and phosphorus. Nitrogen needs attention, and crops may respond to potash in some areas. This soil is fair to good cropland and is considered a Second-class soil.

Robertsville silt loam.—This is a poorly drained soil developed on intermediate and low terraces from alluvium washed mainly from lands underlain by limestone. It is known locally as crawfish land. It occupies almost level areas or slight depressions mainly in the relatively smooth landscape of the Talbott-Colbert-Waynesboro soil association. It is associated with Cumberland, Etowah, and Wolftever soils. The aggregate area is 128 acres.

The soil profile is similar to those of Taft silt loam and Guthrie silt loam, but the soil is generally higher in content of plant nutrients than Taft silt loam and is derived from a greater mixture of materials. The 7-inch surface layer is light-gray or gray friable silt loam faintly mottled with brown and yellow. The subsoil is mottled gray, brown, and yellow tough plastic silty clay that extends to a depth of several feet and generally is more gray and less yellow with depth.

Both external and internal drainage are slow. The soil is low in content of organic matter and is generally strongly acid throughout. It is generally low in content of nitrogen, phosphorus, and calcium. The lower part of the soil is saturated with water during wet seasons, and movement of air and water is slow at all times. Crops and pastures are injured both by very wet and very dry conditions. Tillage is confined to periods of relatively dry weather because of poor drainage, and good tilth is difficult to obtain unless moisture conditions are good. The soil is fairly well suited to hay, pasture, or forest, but other crops are grown on some areas occasionally.

A few small areas are used periodically for corn or hay, but most of the soil is used for pasture, is idle, or is in forest. Pastures are generally unimproved, and 1 acre probably furnishes about 40 days of grazing for one cow during a year. The carrying capacity can be doubled under good pasture management, which involves rather heavy applications of lime and phosphorus. Robertsville silt loam is poorly suited to crops that require tillage and is considered a Fourth-class soil.

Rolling stony land (Colbert soil material).—This land type is commonly called rock land, limestone rock land, or glady land. It is characterized by closely spaced outcrops of limestone and by heavy-textured soil material between the outcrops. In most places outcrops cover between 10 and 50 percent of the land surface and are so spaced that ordinary tillage implements cannot be used satisfactorily (fig. 14, *C*).

The limestone in most places is clayey, the kind that gives rise to Colbert or Talbott soils, and the soil between the outcrops is generally similar to Colbert soils. Small areas of Talbottlike soils are included. The surface layer ranges from a silt loam to a silty clay loam, and the thickness over bedrock ranges from a few inches to several feet. The deepest soil in most places is like Colbert silt loam or Colbert silty clay loam, eroded rolling phase. The slope of the greater part of the area is 5 to 12 percent, but areas with slopes as much as 25 percent or as little as 2 percent have been included in the mapping unit.

The frequency of rock outcrops prevents the use of most areas for crops that require tillage, but the greater part of the land type is moderately well suited physically to permanent pasture. The physical suitability for pasture varies widely from place to place as a result of differences in the thickness and character of soil material over bedrock and of differences in the proportion of the surface occupied by rocks. Bluegrass and white clover commonly constitute a major part of the pasture and furnish fair to good grazing in early spring and late fall, but they provide little grazing during the warmer and drier midsummer months; pastures that include Bermuda grass are usually better for midsummer grazing.

Although no chemical data are available, the soil material appears to be relatively high in content of most plant nutrients. Applications of phosphorus generally improve the quantity and quality of pasture plants, and applications of lime may improve pastures on the areas of deeper soil. The soil is thin over bedrock and holds a small quantity of water, a considerable part of which is held so tightly that it is not available to plants. For these reasons, pastures are likely to be injured more by dry weather on this land type than on soils such

as Dewey silt loam. Permanent springs are frequent, and where water seeps along the buried rock surface pastures remain relatively good during dry periods.

This land type occupies some of the rolling and more stony parts of the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. It is associated mainly with Colbert, Talbott, and Dewey soils. Its aggregate area is 2,304 acres.

Rough gullied land (Apison and Conasauga soil materials).—This land type consists of areas of very severely eroded soils derived from shale. Nearly all of the original surface soil and part of the original subsoil are gone in most places, and a network of short deep gullies in which soft shale bedrock is exposed covers most of the areas. The soils were originally mainly Apison and Conasauga soils, but some areas were Upshur or Montevallo. Slopes range from 5 to 30 percent. This land type resembles rough gullied land (limestone residuum), but the remaining soil material is of different character and the underlying rocks are soft instead of hard.

It was mapped mainly in areas of the Conasauga, Muskingum-Apison, and Jefferson-Clarksville-Upshur soil associations. The largest areas are in the former association, where a very large part of the Conasauga soils is severely eroded. The aggregate area is 1,088 acres.

Workability, conservability, and productivity are low and the land type has been placed with the Fifth-class soils. Most of it is idle and covered by weeds and brush. Some areas have a cover of small old-field pine. It is best suited to foresty, but reclamation is generally necessary before good forest stands can be established. Pine comes in on this land eventually, but the process is very slow. Good results have been obtained when some areas have been planted to kudzu to prevent further erosion and to rebuild the fertility of the remaining soil so that trees can be established.

Rough gullied land (limestone residuum).—This land type consists of areas of very severely eroded Dewey, Fullerton, Clarksville, Cumberland, and Etowah soils. Nearly all of the original surface soil and, in most places, a large part of the original subsoil are gone. Most areas contain numerous gullies, some of which are very deep and expose limestone bedrock. This land type differs from rough gullied land (Apison and Conasauga soil materials) in that it has a deeper cover of raw soil material over bedrock, a hard instead of soft bedrock, and a soil material derived from limestone instead of shale. Most slopes are between 5 and 30 percent.

The land type was mapped mainly in areas of the Talbott-Colbert-Waynesboro, Talbott-Allen-Lindside, and Clarksville-Fullerton soil associations. Its aggregate area is 852 acres.

Accelerated erosion has mutilated the land type to such an extent that reclamation for crops or pasture is generally not feasible, although in places, kudzu has developed a good cover (fig. 15, *B*). Its best use is apparently for forest in most places (fig. 15, *A* and *C*). Much of it is idle and is slowly reverting to timber, but a considerable acreage is in poor permanent pasture where trampling and browsing prevent establishment of trees. Black locust, where planted and protected, appears to survive fairly well.

FIGURE 15.—*A*, Most of the surface soil has been lost on the strongly sloping area of rough gullied land (limestone residuum) in the middle background. Considerable effort will be required to reestablish a high productivity. Gullies are abundant, and further erosion will be difficult to forestall. *B*, Although slow in developing, kudzu is one of the crops best suited to such land, and when once established it maintains a dense cover that protects the soil well against erosion, improves its productivity, and affords a forage crop suitable either for pasture or for hay. *C*, A 5-year old planting on the Harvey Patton farm, 1 mile south of Dayton, of shortleaf pine on a badly gullied area of Fullerton cherty silt loam, hilly phase—a good practice for areas of rough gullied land.

Rough stony land (Muskingum soil material).—This land type consists of steep broken land on which sandstone outcrops predominate, but on which small areas of very shallow Muskingumlike soil exist among the outcrops. Slopes range from 10 to more than 60 percent, but generally average 50 to 60 percent.

This land type is of little or no value either for crops or for pasture and is very poor forest land. Most of the trees are small and grow slowly, although in favorable places some merchantable timber can be produced. Forestry and lumbering operations are generally difficult.

Most of this land type is on the areas of the Muskingum-rough stony land soil association on the Cumberland Plateau and the Cumberland escarpment, but scattered areas are on the Hartsells-Muskingum soil association. It occupies a very large acreage, the aggregate area being 17,920 acres.

Sequatchie fine sandy loam.—This reddish-brown sandy soil occupies low terraces. It is derived from alluvium that consists mainly of materials derived from sandstone but that is influenced slightly by materials derived from limestone.

The soil is more sandy, lighter colored, and lower in content of plant nutrients than is Etowah silt loam. The difference between the surface layer and subsoil layers is generally less distinct than in the Waynesboro or Etowah soils. In cultivated areas the 12-inch surface layer is grayish-brown very friable fine sandy loam underlain by a layer of yellowish- or reddish-brown friable fine sandy loam or fine sandy clay loam, about 20 inches thick. This material is more compact in place than the layer above. Below a depth of 30 to 40 inches, the material is yellowish-brown or light-brown loose and friable fine sandy loam. This layer is less compact in place than the layer above and extends to a depth of 7 feet or more in many places. In some places it may be faintly mottled with yellow or brown in the lower parts. The soil is strongly acid throughout the profile.

The characteristics of this soil favor its use for crops that require tillage. Slopes exceed 2 percent in few places, and the plowed layer is easy to till and to maintain in good tilth. The soil is open and porous and allows rapid movement of both air and water. The water-holding capacity is moderately low, but moisture relations are usually good. The soil is generally in low positions near streams where moisture may be supplied to some extent from the water table. Much of the water that falls on the soil soaks into it. Generally the content of lime, phosphorus, nitrogen, and probably potash is moderately low, but crops respond well to good management that includes fertilization.

This soil is generally in a smooth landscape near streams. It is mapped mainly in areas of the Sequatchie soil association that lie at the base of the Cumberland escarpment along the larger streams that rise on the Cumberland Plateau, or in areas of the Huntington-Wolftever-Sequatchie soil association that are near the Tennessee River. Small areas of Holston, Etowah, and other Sequatchie soils that were too small to be shown were included in the mapping unit. The aggregate area in this county is 2,176 acres.

Almost all of this soil is used for corn, small grain, hay, sericea lespedeza for seed, strawberries, and vegetable crops (fig. 16, *A* and *B*). It is commonly cropped intensively to intertilled crops for several years, followed by 1 or 2 years of small grain and hay. Strawberries and vegetable crops are generally fertilized with moderate applications of a complete fertilizer supplemented by manure where it is available. If no other crop in the rotation is fertilized,

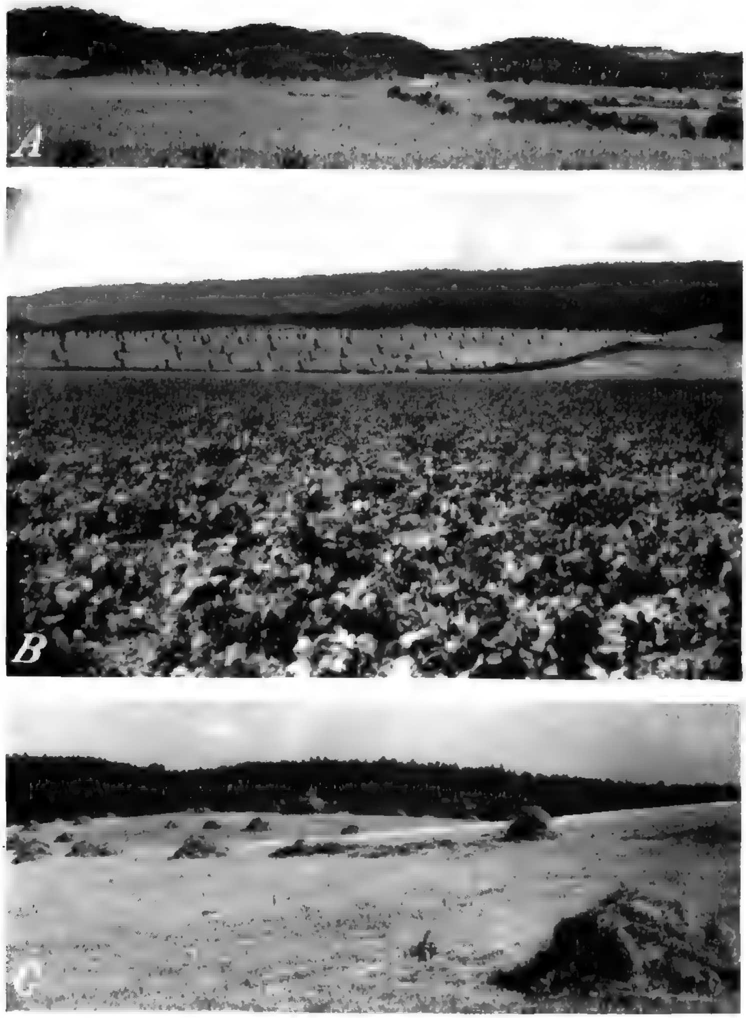

FIGURE 16.—*A*, An area of Sequatchie fine sandy loam used predominantly for corn; with Muskingum soils on the wooded shale ridges of the background; 2½ miles southeast of Spring City. *B*, Sequatchie fine sandy loam in the foreground supports a good crop of string beans for the Chattanooga market; Waynesboro fine sandy loam in the middle ground, a crop of corn, chiefly for livestock feed; and Muskingum soils in the background, natural forest of hardwoods and pine. View southwest of Spring City. *C*, Lespedeza and crabgrass hay on Allen very fine sandy loam, eroded sloping phase, with forest on Hector and Muskingum soils; north edge of the county.

corn generally receives manure or a light application of superphosphate at long intervals. Green manures are seldom used. Under this management, corn commonly produces 25 to 30 bushels to the acre, wheat 12 to 15 bushels, and lespedeza hay about 0.9 ton. Some alfalfa is grown. The land generally receives heavy applications

of lime and phosphorus at seeding and produces about 1¾ to 2 tons of hay to the acre.

The outstanding management requirement is to increase and maintain the content of plant nutrients and of organic matter. In most cases nitrogen, phosphorus, and probably potash are the limiting nutrients, and the soil is strongly acid and requires liming for most of the common crops. There is little problem of runoff, so that special tillage practices or engineering methods for its control are generally not necessary. Good tilth is easily obtained and maintained. The soil is moderately productive of most of the crops commonly grown and is exceptionally well suited to vegetables and strawberries. It requires relatively heavy fertilization and careful choice and rotation of crops for maintenance of plant nutrients. It is a Second-class soil.

Sequatchie loamy fine sand.—This is a brown sandy excessively drained soil that occupies low terraces. It is derived from alluvium that consists of materials washed from soils underlain mainly by sandstone and appears to be influenced slightly by materials derived from limestone. The soil is more sandy and is lighter in color than Sequatchie fine sandy loam. The difference between surface soil and subsoil layers is very slight. In cultivated areas the surface layer is brownish-gray friable loamy fine sand about 12 inches thick underlain by yellowish-brown loose fine sandy loam about 20 inches thick, and below a depth of 30 to 40 inches the material is commonly brownish-yellow or light-brown loose loamy fine sand. It is strongly acid throughout the profile.

The characteristics are conducive to easy tillage and easy conservability of soil material, but they favor rapid loss of plant nutrients by leaching and injury of crops by drought. The land ranges from almost level to sloping. The gradient is 1 to 10 percent, the greater part being between 1 and 5 percent. The soil is open and porous and allows rapid infiltration of water. The water-holding capacity is low. In some places the soil is in low positions near streams, and crops may benefit by a relatively high water table. The content of lime, phosphorus, nitrogen, and potash is generally low, and crops respond to their application if favorable moisture conditions exist.

This soil is generally in a smooth landscape near streams. It is mapped mainly in the Sequatchie soil association near the base of the Cumberland escarpment and is associated with Sequatchie fine sandy loam, Jefferson very fine sandy loam, and sandy soils of the first-bottom lands. The aggregate area is 1,408 acres.

Nearly all areas have been cleared. Corn is one of the principal crops, but small acreages of other crops, generally truck crops, are also grown. A common cropping system is the use of the soil for corn or for other intertilled crops for several years and then idleness for a considerable period. As a consequence, considerable areas of the soil are idle and are covered by weeds and brush. Very little fertilizer is used except on truck crops. Yields of almost all crops are considerably lower than on Sequatchie fine sandy loam.

Although this soil has a nearly level relief, is easy to till, and presents but little of a problem in conservation of soil material, it is not a good soil for agriculture. It has a low moisture-holding capacity and is

excessively drained internally. Crops on it commonly suffer from drought in dry weather. The principal management requirement, aside from conservation of water, is the maintenance of organic matter, nitrogen, phosphorus, lime, and potash. Because of the ease with which water percolates through the soil, moderate applications of the more soluble fertilizer materials, such as potash and nitrogen, at short intervals probably would be more advisable than heavy applications at long intervals. This is a Third-class soil.

Staser loamy fine sand.—This is a sandy slightly acid or neutral dark-colored soil of the natural levees of first bottoms. It is derived from alluvial materials washed mainly from soils underlain by limestone, sandstone, and shale. It is a young soil.

The soil profile resembles that of Pope fine sandy loam, except that it is more sandy and is generally darker colored. Distinct surface soil and subsoil layers have not developed. To a depth of 6 to 10 inches the material is generally brown loamy fine sand slightly acid or neutral, underlain by dark grayish-brown slightly acid loamy fine sand that extends to a depth of several feet. In some places this dark-colored layer is absent, and the upper layer grades into lighter brown loamy fine sand.

This soil is lower in content of most plant nutrients than is Huntington fine sandy loam, but it contains more lime than Pope fine sandy loam. Drainage is good to slightly excessive. The soil is flooded for short periods during high flood stages. Practically all of the 448 acres mapped is on natural levees near the Tennessee River in the smooth landscape of the Huntington-Wolftever-Sequatchie soil association. It exists as long narrow areas adjacent to Huntington or Lindside soils.

The soil is commonly used for corn year after year, but hay crops may be planted at long intervals. Fertilizers or other amendments are seldom used. Under this management, corn commonly produces about 30 bushels an acre and lespedeza about three-fourths ton of hay. Staser loamy fine sand can be used intensively for intertilled crops, but good management should include relatively heavy fertilization with phosphorus and probably potash for most crops. Liming is generally not necessary, but provision should be made for maintenance of organic matter. Vegetables would do well on this soil, as it is responsive to fertilization and dries early in the spring. It is only moderately productive of most crops and has a tendency to be droughty, but it is easy to work and can be maintained in good tilth with a minimum of effort. The maintenance of a high nutrient level is one of the main problems of management. It is a Third-class soil.

Stony colluvium (Muskingum soil material).—This is a land type that consists of sandstone fragments and boulders embedded in a matrix of sand and silt. It is most common on smooth to sloping areas along the swift streams where they emerge from the Cumberland escarpment, and the material is the rock debris carried out of the Cumberland Plateau during floods and deposited near the foot of the escarpment where the waters are slowed by the more gentle gradients of the streams of the Valley and Ridge province. Boulders up to 2 feet in diameter are common. Most of this land type is at the base of the Cumberland escarpment in areas of the Sequatchie or the Jeffer-

son-Clarksville-Upshur soil association. Its aggregate area is 1,664 acres.

The areas of this land type are flooded during periods of heavy rains, but they are well drained to excessively drained during periods of normal rainfall. In many places the boulders are too numerous to permit tillage with horse-drawn implements, but a few of the less stony areas can be tilled. Generally, the soil is very low in fertility, and the moisture-holding capacity is so low that cultivated crops or pasture do very poorly except during exceptionally rainy seasons. Largely for these reasons, this land type has been included with the group of Fifth-class soils. Its best use in most places appears to be for forest. In a few places its use for early summer crops is feasible. In the vicinity of Graysville and Spring City a few vegetable gardens for early home use are on this land type, but after midsummer they generally produce little.

Taft silt loam.—This is an imperfectly drained light-colored soil developed on terraces from alluvium washed mainly from lands underlain by limestone. It differs from Etowah and Wolftever soils, with which it is commonly associated, mainly in characteristics that result from restricted drainage.

In cultivated fields the upper layer is gray or brownish-gray friable silt loam about 8 inches thick that is underlain by a 12-inch layer of yellowish-gray slightly sticky heavy silt loam or silty clay loam. This layer is underlain by mottled yellow, dark-brown, and gray sticky silty clay loam that grades into sticky and plastic silty clay at a depth of about 30 inches. A few small pockets of sand and some gravel or chert fragments are in this layer in places. The highly mottled plastic silty clay extends to a depth of several feet. All layers are strongly acid. A few small areas on which the soil is similar to that described above, except for a fine sandy loam surface layer, are included with the mapping unit.

The soil has almost level relief, and both external and internal drainage are slow. The water table is high in the soil until late in the spring, and during wet seasons the soil is very wet and soggy. Many areas of this soil are flooded during high waters on the Tennessee River. The content of plant nutrients is moderately low; nitrogen, phosphorus, and calcium being the principal limiting elements. The content of organic matter is generally medium to low. The soil is moderately easy to till and to maintain in good tilth, but it is fairly well suited to only a limited number of crops and is only moderately productive of most of them. Taft silt loam occupies almost level areas in the smooth landscape of the Huntington-Wolftever-Sequatchie soil association or in the undulating to gently rolling landscape of the Talbott-Colbert-Waynesboro soil association. Areas of this soil are rather small and widely scattered, and are generally associated with areas of Wolftever, Robertsville, and Etowah soils and are commonly found near small drainageways on terraces. The aggregate area is 1,088 acres.

At least 80 percent of this soil is cleared and used for crops or pasture. Corn and hay are the crops most commonly grown, but oats and rye are grown on some areas. Corn commonly is grown more than half the time. Very little fertilizer or lime is used for these crops, but corn usually receives light applications of superphosphate, or low-

analysis complete fertilizer, or available manure at moderately long intervals. Green manures are seldom used. Under this level of management, corn produces about 20 bushels an acre, lespedeza hay about three-fourths ton, and oats about 18 bushels.

Improvement of drainage and maintenance of the level of plant nutrient and organic matter for good production are the outstanding management problems of this soil. It is strongly acid and generally deficient in nitrogen and phosphorus. It may be deficient in potash after intensive cropping. Imperfect drainage limits production of some crops, and the use of deep-rooted crops such as sweetclover or sericea lespedeza would improve internal drainage. The soil is limited in its suitability for crops, and corn, hay, sorghum, fall vegetables, and pasture are among the crops to which it is best suited. It is only moderately productive of these crops; it is fairly easy to till and to maintain in good tilth; and its plant-nutrient level is moderately difficult to maintain at a high level. It is a Third-class soil. A very small inclusion of Tyler silt loam is mapped with Taft silt loam.

Talbott silt loam.—This is an undulating heavy-textured yellowish-red soil developed from the residuum of weathered moderately clayey limestone on the undulating valley uplands.

The soil profile resembles Dewey silt loam except that it is thinner over bedrock, is yellowish-red instead of red, and has a heavier textured more plastic subsoil. In cultivated fields the topmost layer is brownish-gray to grayish-brown friable silt loam about 8 inches thick. The 24-inch subsoil is yellowish-red compact moderately sticky and plastic silty clay. There are generally a few splotches of light gray and yellow in the lower part of this layer. The parent material, which underlies the subsoil, is highly mottled and splotched yellow, reddish-brown, and gray sticky plastic silty clay. These materials generally rest on an uneven bedrock floor at a depth between 3 and 5 feet. The bedrock is a moderately clayey limestone.

The heavy-textured subsoil retards the rate of infiltration and percolation of water. As a result, runoff is generally swift for a soil whose slope is less than 5 percent. The soil is moderately susceptible to accelerated erosion and is subject to extreme alternate wet and dry conditions in the surface layer. It is moderately well supplied with plant nutrients compared with other soils of the county, but nitrogen, phosphorus, and calcium are generally limiting factors in crop production. The soil is strongly acid throughout the profile. The content of organic matter is medium to low, depending on the management of the soil. Potash is less apt to be the limiting factor in crop production than on soils such as those of the Fullerton and Clarksville series.

This soil occupies some of the almost level to undulating areas of the relatively smooth valley uplands. It was mapped mainly in the relatively smooth landscapes of the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations. In the first, it is associated mainly with Dewey, Etowah, Allen, and other Talbott soils; in the second, with Colbert, Waynesboro, Etowah, and other Talbott soils and with rolling stony land (Colbert soil material). Its aggregate area is 832 acres.

More than 90 percent of this soil has been cultivated, and most of it is used for crops that require tillage. A relatively small acreage is

used for pasture. Corn, wheat, oats, lespedeza (fig. 17, *A*), red clover, and alfalfa are the principal crops. A common rotation is corn, wheat, and red clover. If alfalfa is used, it generally remains on the land for several years. The soil is commonly limed for alfalfa and red clover, and phosphorus is usually applied under alfalfa at seeding. The manure available is generally used on cornland. Under this level of management average yields of 25 bushels of corn to the acre, 14

FIGURE 17.—*A*, A good crop of lespedeza on Talbott silt loam in that part of the county represented by the Talbott-Colbert-Waynesboro soil association. *B*, Lespedeza is the most important single hay crop grown in the county, and it is raised on practically all soils commonly tilled. In this view, 1 mile southwest of Dayton, a crop of hay on Talbott silty clay loam, eroded phase, is being baled directly from haycocks in the field. Beyond the meadow is an excellent stand of shortleaf pine established on a strip of abandoned land.

bushels of wheat, and $2\frac{1}{2}$ tons of alfalfa hay are to be expected. Yields of crops range widely under comparable management from year to year; however, the variation depends largely on the quality and distribution of rainfall.

Good soil management involves supplying lime and phosphorus in rather large quantities. The soil has the ability to hold relatively large quantities of plant nutrients, so that heavy applications of these amendments at long intervals are probably preferable to small applications at short intervals. This is particularly true of lime. Maintenance of nitrogen requires constant attention and can generally be ac-

complished by the use of legumes, manure, and green manure. The use of manure, or green manure, or the growing of sod-forming crops aids in maintenance of good tilth and improvement of conditions for infiltration of water. Deep-rooted crops such as alfalfa or sweetclover aid in improvement of the physical condition of the subsoil. More care should be exercised to control runoff than on most soils of similar slope. The soil is moderately productive of the common field crops and is moderately easy to till and to conserve under cultivation. It is a Second-class soil.

Talbott silty clay loam, eroded phase.[11]—This is a rolling heavy-textured moderately eroded yellowish-red soil developed on the rolling valley uplands from the residuum of weathered moderately clayey limestone.

The soil has steeper slopes, 5- to 12-percent gradient, and has a thinner surface layer than Talbott silt loam. The original silt loam surface soil has been so eroded that the heavier textured red subsoil material is commonly turned up in plowing. In cultivated fields the topmost layer is grayish-brown tinged with red moderately friable silty clay loam about 5 inches thick. The subsoil is yellowish-red compact moderately sticky and plastic silty clay about 24 inches thick. The parent material, which underlies the subsoil, is highly mottled yellow, reddish-brown, and gray sticky plastic silty clay.

The rate of runoff is more rapid and the rate of infiltration of water is slower than on Talbott silt loam. As a consequence, the quantity and rate of runoff and the physical character of the material make this soil susceptible to accelerated erosion. It is also subject to extreme alternate wet and dry conditions but is moderately well supplied with most plant nutrients, although nitrogen, phosphorus, and calcium are commonly limiting in crop production. Nitrogen is generally more limiting than in Talbott silt loam. The soil is strongly acid throughout the profile.

This soil occupies some of the rolling areas of the relatively smooth valley uplands. It is mapped mainly in the relatively smooth landscapes of the Talbott-Allen-Lindside and Talbott-Colbert-Waynesboro soil associations, and it is associated with the same soils as Talbott silt loam. Its aggregate area is 1,408 acres.

Most of this soil has been cultivated, and much of it is used for crops that require tillage. Much of it is idle or in unimproved poor permanent pasture. Corn, wheat, oats, lespedeza (fig. 17, *B*), red clover, and alfalfa are the crops commonly grown. Lime is generally used for alfalfa and for red clover at the time of seeding. Phosphorus is commonly used for alfalfa and sometimes for red clover, but very little fertilizer is used for the other crops. Corn produces about 20 bushels an acre, wheat about 11 bushels, and alfalfa hay about 2 tons. These yields are lower than those commonly obtained on Talbott silt loam.

Good soil management involves supplying lime and phosphorus in relatively large quantities, increase and maintenance of organic matter and nitrogen, and control of runoff. The soil should be used for sod-forming or close-growing crops as much of the time as is feasible in good farm management and not left bare of vegetation longer than

[11] See footnote 8, p. 46

necessary. The use of barnyard manure or green manure is particularly beneficial in the maintenance of nitrogen and the improvement of tilth. Productivity is medium, but workability and conservability are moderately low. This is a Third-class soil.

Upshur silt loam.—The 8-inch surface layer is purplish-brown friable silt loam containing small sandstone fragments in some places. A large part has lost half of its original surface layer as a result of erosion, and as a consequence the plow layer is composed of a mixture of surface and subsoil material. Below this layer and extending to a depth of about 24 inches is dull-red or purplish-red moderately plastic silty clay underlain by mottled purple, yellow, gray, and brown silty clay that is plastic when wet and brittle and hard when dry. Bedrock of purplish calcareous shale is at a depth of 2 to 4 feet. This soil resembles Conasauga silt loam in that it is derived from calcareous shale; it differs chiefly in being purplish rather than yellowish, in having a greater depth to bedrock, and in being more fertile.

The relief is undulating to rolling, but the gradient for the most part ranges from 5 to 12 percent. Both surface and internal drainage are good, although in places external drainage is rapid. The greater part of the 192 acres mapped is along the southeastern edge of that part represented by the Jefferson-Clarksville-Upshur soil association. The larger areas are between Evensville and Roddy, half a mile west of the railroad. A large part of it has been cleared.

General farm crops as corn, wheat, oats, and certain hay crops are grown, and some strawberries and tomatoes are raised as cash crops. Some fertilizer is used, but most of it is for truck crops and wheat. The natural productivity is fair to good, and its workability is moderately good. It is subject to erosion, and for this reason, at least moderately long rotations are to be preferred. Under common management, corn yields range from 20 to 25 bushels to the acre, wheat 10 to 15 bushels, oats 25 to 30 bushels, and strawberries 30 to 40 crates. During favorable seasons tomatoes yield moderately well. Lespedeza is probably the most common hay crop, and yields under average conditions range from ¾ to 1¼ tons to the acre. Alfalfa is not a common crop, but with proper fertilization and seeding it yields fairly well. In general, all crops respond well to applications of phosphate and lime.

Upshur silt loam, hilly phase.—This soil differs from the normal soil chiefly in that it has a hilly relief, the average gradient ranging from 12 to 30 percent. The thickness of the surface soil and depth to bedrock is more variable than for the normal type, and the average depth to bedrock is less. Surface drainage is excessive, but internal drainage is moderately slow although adequate.

The aggregate area is 448 acres, and most of it is along the southeastern edge of that part of the county represented by the Jefferson-Clarksville-Upshur soil association. Very little of this soil has been cleared, and most of it at the present time is occupied by a mixed forest of hardwoods. Those areas that have been cleared for several years almost invariably have lost an appreciable part of the surface layer as a result of erosion. When first cleared, this soil produces good yields of most crops commonly grown. Chiefly because of its strong slopes and relatively slow permeability, tilled areas erode very rapidly and soon drop sharply in productivity. Because of its suscepti-

bility to erosion, this soil is better suited to permanent pasture than to crops that require tillage. Under average conditions, especially if lime and phosphate are used and proper seeding is made, good grazing can be maintained throughout most of the growing season except during the driest parts of midsummer.

Upshur silty clay loam, eroded phase.—This soil has lost 50 to 75 percent of its surface soil. The subsoil ordinarily is exposed in patches, and the plow layer generally is composed partly of subsoil material. In places the surface soil has been lost entirely, and in such areas the plow layer consists entirely of subsoil material. The relief is rolling; the slope ranges from 5 to 12 percent. Surface drainage is slightly excessive, and internal drainage, although slow, is adequate for all crops common to this section.

Most of the 896 acres mapped is along the eastern edge of that part represented by the Jefferson-Clarksville-Upshur soil association. All the acreage has been cleared and cropped at some time, and a large part of it is now used for crops. Approximately the same crops are grown as on the normal type, but chiefly because of its eroded condition, yields are somewhat lower. Some sericea lespedeza is producing very good yields of hay. Fertilizers are not generally used, except for truck crops and wheat. Because of its susceptibility to erosion, relatively long rotations are advisable, and if tillage is practiced, particular attention must be given to the control of water to maintain a productive state.

Upshur silty clay loam, eroded hilly phase.—This soil has a hilly to steep surface and has lost a considerable part of the soil material. The quantity of soil lost varies considerably. In some places, little more than 50 percent of the surface soil has been lost, although in others all of the surface soil and part of the subsoil has been removed. In these latter areas gullies are common.

The aggregate area is 1,472 acres, and most of it lies as a broken belt northeast of Graysville in that part represented by the Jefferson-Clarksville-Upshur soil association. There are a few small areas southwest of Watts Bar Dam and on the ridge southeast of Euchee School. Surface drainage is excessive, and internal drainage is adequate. All this soil has been cleared and cropped at some time, but a large part now lies idle or is used as pasture. Its productivity is low, its workability difficult, and the problem of conservation very great. Accordingly, it is poorly suited to crops that require tillage, and a considerable acreage, especially in the most severely eroded parts, is best used as forest land. Some of the acreage is covered by shortleaf pine, which seems to do well. Many telephone poles and small saw trees are cut from the reforested areas. Black locust appear to be well suited to this soil. Where erosion has not been too severe, it appears probable that pasture can be established with proper preparation of the soil, including fertilizer and proper seeding.

Waynesboro fine sandy loam.—This is a gently sloping moderately fertile red soil developed on high terraces from old alluvium that consists mainly of sandstone and shale materials. It is influenced moderately by material derived from limestone.

The soil profile is slightly lighter colored and lighter textured than that of Cumberland silt loam and contains little gravel in the

upper part. The 6- to 8-inch surface layer is grayish-brown friable fine sandy loam underlain by a 6-inch layer of yellowish-brown sandy loam to silt loam. The subsoil is red or brownish-red moderately compact but friable fine sandy clay loam or silty clay loam extending to a depth of about 40 inches. The underlying parent material is red moderately compact silty clay slightly mottled and streaked with yellow. Soft sandstone gravel is in the subsoil and substratum. The soil is strongly acid throughout the profile.

The characteristics of this soil make it fair to good cropland. Its slopes are less than 5 percent. It is not appreciably eroded and is not seriously subject to erosion. It has good physical properties for the establishment and maintenance of good tilth. The soil is well drained and has a moderate water-holding capacity. It is permeable to air and water, and plant roots penetrate the subsoil freely. There are few or no stones or gravel on the surface, and workability is very good. The major deficiency is its moderately low content of plant nutrients.

This soil occupies the smoother parts of undulating to hilly valley uplands and is associated with Nolichucky, Holston, and other Waynesboro soils. It was mapped mainly in the areas occupied by the Talbott-Colbert-Waynesboro soil association, which lie between the cherty ridges and the Tennessee River. It occupies an area of 320 acres.

Most of the soil is cleared and used for the field crops commonly grown or for permanent pasture. Corn (see fig. 16, *B*), small grain, lespedeza, soybean hay, and some vegetables are the principal crops. The soil is commonly used for an intertilled crop for 2 or 3 years followed by small grain and lespedeza for 1 or 2 years. Applications of lime are generally made at long intervals, and moderate to light applications of superphosphate or of low-analysis complete fertilizer are commonly made for corn at moderately long intervals. Vegetable crops are generally fertilized more heavily than corn but not heavily enough to be considered adequate in most cases. Manure is used, where available, on soil for corn or other intertilled crops. Green manures are seldom used.

Yields under the more common levels of management are slightly lower than those commonly obtained on Cumberland gravelly fine sandy loam and are similar to those on Waynesboro gravelly fine sandy loam. Corn yields about 30 bushels an acre, wheat about 15 bushels, and lespedeza hay slightly more than 1 ton. Pastures are generally unimproved, and 1 acre furnishes about 70 days of grazing for 1 cow a year.

The principal management requirements are for the maintenance of plant nutrients and organic matter. Nitrogen, phosphorus, and lime are commonly limiting. Potash may be limiting also if the soil is cropped intensively. Organic matter disappears rapidly when the soil is used for intertilled crops. Special tillage practices and engineering methods are generally not necessary for the control of runoff. The soil is moderately productive of most crops usually grown, and it is easy to till and to conserve. As the soil requires moderately intensive management practices for the maintenance of a high nutrient level, it is a Second-class soil.

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Waynesboro fine sandy loam, eroded sloping phase.—This is a sloping moderately fertile eroded red soil of medium fertility developed on high terraces from old alluvium consisting mainly of materials derived from sandstone and shale. It is moderately influenced by material derived from limestone.

The soil has steeper slopes and a thinner surface layer, as a result of accelerated erosion, than Waynesboro fine sandy loam. The upper 4 or 5 inches is grayish-brown or yellowish-brown tinged with red moderately friable fine sandy loam. The subsoil is red or brownish-red moderately compact but friable fine sandy clay loam or silty clay loam about 35 inches thick. The underlying parent material is red moderately compact silty clay slightly mottled and streaked with yellow. Soft sandstone gravel are in the subsoil and in the substratum. The soil is strongly acid throughout.

The characteristics of this soil make it only fair cropland. It is eroded, and red subsoil material is commonly within plow depth and is mixed with the surface layer in cultivated fields. The soil is moderately absorptive of water; but the runoff is relatively rapid, so that the soil is not only subject to loss of water needed by crops but to further erosion unless well managed. Good tilth is fairly easy to establish and maintain. The subsoil is permeable to water, and plant roots penetrate it freely. The major deficiency consists in its rather low content of plant nutrients.

This soil occupies 640 acres on some of the sloping or rolling parts of undulating to hilly valley uplands and is associated with Nolichucky, Holston, and other Waynesboro soils. It is mapped mainly in the areas occupied by the Talbott-Colbert-Waynesboro soil association that lies between the cherty ridges and the Tennessee River.

Almost all of the soil is cleared. A large part is idle or in poor unimproved permanent pasture and supports a cover of the less desirable pasture grasses, weeds, shrubs, or small trees. Corn, small grains, and lespedeza occupy the greater part of the rest. Common management of the cropland is similar to that described for the typical soil, except that periodic idleness or use for unimproved permanent pasture is common. Crop and pasture yields are generally lower under the more common management practices. Corn produces on the average about 20 bushels to the acre, wheat 10 to 12 bushels, and lespedeza hay about 0.9 ton; an acre of permanent pasture usually yields about 55 days of grazing in a season for 1 cow.

The principal management problems are control of runoff and maintenance of organic matter, nitrogen, phosphorus, lime, and probably potash. The soil is moderately productive of most crops under good management but requires rather intensive management for maintenance of productivity. For this reason it is a Third-class soil.

Waynesboro gravelly fine sandy loam.—This gently sloping red gravelly soil developed on high terraces from old alluvium consists mainly of sandstone and shale material and is probably influenced to some extent by limestone materials. It is more gravelly than Waynesboro fine sandy loam.

The soil profile has distinct surface soil and subsoil layers. In cultivated fields the upper 6 or 8 inches is grayish-brown friable gravelly fine sandy loam containing a moderate to low quantity of organic

matter, which is underlain by about 6 inches of yellowish-brown friable gravelly fine sandy loam or silt loam. The subsoil is red or brownish-red moderately compact but friable gravelly fine sandy clay loam or gravelly silty clay loam that extends to about 40 inches. The parent material is red moderately compact gravelly silty clay, slightly mottled and streaked with yellow. Pieces of soft sandstone gravel increase slightly in number with depth. The soil is generally strongly acid.

The soil is fair to good cropland. With a gradient of less than 5 percent, it is not appreciably eroded and is not seriously susceptible to erosion. It has good physical properties for the establishment and maintenance of good tilth, is well drained, has a moderate water-holding capacity, and as it is permeable to water and air, plant roots penetrate the subsoil freely. Gravel in places interferes to some extent with tillage. The major deficiency is in its moderate to low content of plant nutrients.

Waynesboro gravelly fine sandy loam occupies old high terraces in association with Nolichucky, Holston, and other Waynesboro soils. It is mapped mainly between the Tennessee River and the cherty ridges in the area occupied by the Talbott-Colbert-Waynesboro soil association. It is in a landscape of undulating to hilly valley upland, and the 128 acres mapped occupies some of the smoother parts of that landscape.

Most of the soil is cleared and used for the common field crops or for pasture. Corn, small grain, lespedeza, soybean hay, and some vegetables are the principal crops. Often the land is used intensively for intertilled crops for 2 or 3 years followed by small grains or lespedeza hay for 1 to 2 years. Applications of lime are made at long intervals, and the major commercial fertilizer commonly used consists of moderate applications of superphosphate or low-analysis complete fertilizer for corn. Vegetable crops are usually fertilized with moderate applications of complete fertilizer. Manure is used where available on corn or other intertilled crops. Corn generally yields about 25 bushels an acre, wheat 10 to 12 bushels, and lespedeza about 0.8 ton of hay. These yields could be increased considerably by management better adjusted to the needs of the soil. Yields are generally slightly lower than on Waynesboro fine sandy loam. It is moderately productive of most crops commonly grown, is moderately easy or easy to till, but requires rather intensive management practices for the maintenance of fertility. Because of these characteristics it is considered a Second-class soil.

The principal management requirements are for the maintenance of plant nutrients. The soil is fairly fertile, but most crops respond well to management practices that tend to increase or maintain nutrient and organic matter. Nitrogen, lime, and phosphorus are most commonly limiting, but potash deficiency is to be expected under continuous cropping. Organic matter disappears rapidly under intensive cropping, and efforts should be made to maintain it. Special tillage practices and engineering methods for the control of runoff are generally not necessary.

Waynesboro gravelly fine sandy loam, eroded hill phase.—This strongly sloping moderately eroded red soil is developed on high terraces from old alluvium consisting mainly of sandstone and shale

materials that has probably been influenced by limestone. The soil profile is essentially a truncated profile of the typical soil. In most places enough of the surface layer has been lost through erosion to permit some of the red subsoil material to be turned up in plowing. In cultivated fields the upper 6 inches is grayish-brown tinged with red friable gravelly fine sandy loam. The subsoil is red or brownish-red moderately compact but friable gravelly silty clay loam or gravelly fine sandy clay. The soil is strongly acid throughout the profile.

This phase is poorly suited to crops requiring tillage but moderately well suited to permanent pasture. Runoff is relatively rapid on its 12- to 30-percent slopes unless measures are taken for its control. The moderately eroded and moderately low content of organic matter of this soil permits a moderate water-holding capacity, but infiltration of water should be encouraged. As the soil is permeable to water and air, plant roots penetrate the subsoil easily. It is generally deficient in lime, phosphorus, and nitrogen, and may be deficient in potash.

This soil occupies the escarpments and more steeply sloping areas of old high terraces in undulating to hilly valley uplands associated with Nolichucky, Holston, and other Waynesboro soils, and small areas of the more steeply sloping and moderately eroded Nolichucky and Holston soils have been included in the mapping unit. The mapping was done mainly in the area occupied by the Talbott-Colbert-Waynesboro soil association between the cherty ridges and the Tennessee River. Its aggregate area is 512 acres.

At least 90 percent of the soil is cleared, and most of it has been cleared for many years. Almost all of it was cleared at one time and used for the common field crops, as corn and small grains, but at present much of it is idle or is used for permanent pasture, most of which is unimproved and produces low yields. A small part is used for corn, lespedeza, and soybean hay, but the yields are very low. One acre is estimated to provide about 40 days of grazing for 1 cow, and the quality of the pasture is generally poor. The carrying capacity can almost be doubled under good pasture management.

The principal management requirements are to control the runoff and to increase and maintain organic matter, nitrogen, phosphorus, and lime. Control of runoff prevents erosion and keeps the water on the land for use by plants. This can generally be accomplished by the establishment and maintenance of a good pasture sod by means of liming and applications of phosphorus, with reseeding where necessary. An application of potash or manure is beneficial in obtaining a good stand of desirable pasture plants. Nitrogen can generally be maintained in the pasture by legumes. Contour furrowing may be advisable in some pastures to encourage infiltration of water. If crops that require tillage are grown, the rotation should include close-growing and sod-forming crops as much of the time as feasible, and the soil should be bare of vegetation as little as possible. Green manure, barnyard manure, fertilization and liming, and contour tillage are also parts of good soil management.

This Fourth-class soil is poorly suited to crops that require tillage but is fairly well suited to permanent pasture. It is difficult to till and to conserve when tilled. It is moderately productive of pasture under good management.

Waynesboro gravelly fine sandy loam, eroded sloping phase.—This sloping moderately eroded red soil is developed on high terraces from old alluvium consisting mainly of sandstone and shale materials moderately influenced by material derived from limestone. The soil profile resembles the typical soil, except that the red subsoil is generally within plow depth. In cultivated fields the upper 6 inches is grayish-brown tinged with red friable gravelly fine sandy loam. The subsoil is red or brownish-red moderately compact but friable gravelly silty clay loam or fine sandy clay. The soil is strongly acid throughout the profile.

The characteristics of the soil cause it to be only fairly well suited to crops that require tillage. Its gradient ranges between 5 and 12 percent, and the soil is eroded to a depth that red subsoil material is reached in most places during tillage. The content of organic matter and nitrogen is low, and the content of lime, phosphorus, and probably potash is low or moderately low. The soil has a moderate water-holding capacity and should be carefully managed so that much of the water remains on the land. The pieces of gravel on the surface and in the soil interfere slightly to moderately with tillage.

This phase occupies moderately sloping or rolling areas of old high terraces in undulating to hilly valley uplands associated with Nolichucky, Holston, and other Waynesboro soils, and small areas of moderately eroded sloping Nolichucky and Holston soils are included. The 768 acres is mapped in the areas occupied by the Talbott-Colbert-Waynesboro soil association between the cherty ridges and the Tennessee River.

Almost all of this soil is cleared. A fairly large part of its area is idle at present and supports a cover of weeds, shrubs, and small trees. Corn, small grains, lespedeza, and unimproved permanent pasture occupy most of the rest. Crop and pasture yields are generally low under the more common management practices. Corn yields about 15 bushels to the acre, wheat about 8 bushels, lespedeza hay about three-fourths ton, and permanent pasture about 50 days of grazing in a season for 1 cow.

The increase and maintenance of organic matter and plant nutrients and the control of runoff are the main management problems. The rotation should be so adjusted that close-growing and leguminous sod-forming crops occupy the soil as much of the time as feasible. Nitrogen can generally be maintained by the use of legumes or manure, but lime and phosphorus generally must be applied from commercial sources. Tillage should be on the contour as far as practicable, and terracing may be advisable on some of the longer slopes.

This Third-class soil is considered a fair to good cropland and fair pasture land. It is moderately productive of most crops under good management but is moderately difficult to till and to conserve.

Wolftever silt loam.—This is an almost level moderately well-drained brown soil developed on low terraces from alluvium consisting of materials washed mainly from lands underlain by limestone. It occupies positions that are only slightly above the well-drained first bottoms of the Tennessee River and larger streams of the county and adjacent to the first bottoms, but is mapped in a few places near the riverbank where a natural levee has been thrown up by floodwaters. The soil may be flooded infrequently by very high waters.

The profile is lighter brown in the surface soil and less red in the subsoil than Etowah silt loam, has a more compact subsoil and slightly retarded internal drainage, and is mottled below a depth of 20 to 25 inches. In cultivated fields the topmost 7 inches is brownish-gray friable silt loam. The subsoil is about 25 inches thick and consists of yellowish-brown compact silty clay loam that is brittle and moderately friable when moist. The compactness of this layer is one of the distinguishing characteristics; the lower 8 or 10 inches is generally mottled and streaked with yellow and brown and approaches a silty clay in texture. Below 30 or 35 inches the material is highly mottled yellow, gray, and dark-brown firm but moderately friable silty clay that is sticky when wet. Small soft brown concretions are in all parts of the soil mass and on the surface in many places. The reaction is generally strongly acid throughout the profile.

Because of the compact subsoil, which retards root penetration, and the consequent moderately slow internal drainage this soil is less desirable than Etowah silt loam for agriculture. Drainage is sufficient, however, for most crops commonly grown in the county to be produced with fair to good yields. The soil is easy to till and to maintain in good tilth. Its slopes rarely exceed 2 percent, therefore it is not subject to serious erosion. A fair supply of most plant nutrients are available, but lime and phosphorus are the limiting factors.

It occurs in a smooth landscape near the Tennessee River and generally lies between the Etowah and Cumberland soils on the one side and the Lindside and Huntington soils on the other. The 1,472 acres mapped is in areas occupied by the Huntington-Wolftever-Sequatchie soil association.

Almost all of this type is used for corn, small grain, and hay, which are commonly grown in a rotation in which corn occupies the soil more than half the time. Small acreages are used for other common field crops and for pasture. Fertilizers are seldom used except for light applications of superphosphate or complete fertilizer under corn at relatively long intervals. Yields obtained under the more common level of management are generally lower than those obtained on Etowah silt loam. Corn produces about 25 bushels an acre, wheat about 12 bushels, and lespedeza hay 1 to 1¼ tons.

Maintenance of a high level of lime, phosphorus, nitrogen, and organic matter and the improvement of internal drainage are the outstanding management requirements. Lime and phosphorus generally need to be supplied from commercial sources; content of nitrogen and organic matter can be maintained by proper choice and rotation of crops and return of crop residues or manure to the land. The use of deep-rooted crops, such as sweetclover or sericea lespedeza, may aid in improvement of internal drainage. No special tillage practices or engineering methods are necessary for the control of runoff. This soil, which is grouped as a Second-class soil, is moderately productive, easy to till, and moderately easy to conserve under tillage.

Wolftever silty clay loam, eroded sloping phase.[12]—This is a sloping brown soil moderately eroded with slightly imperfect drainage developed on low terraces from alluvium consisting of material washed mainly from lands underlain by limestone. It occupies posi-

[12] See footnote 8, p. 46.

tions only a little above the well-drained first-bottom lands and is subject to overflow at very long intervals.

This phase differs from Wolftever silt loam principally in that it has steeper slopes, which range from 5 to 12 percent, and it has little or none of the original silt loam surface soil remaining. Much of the erosion is the result of scouring by overflow waters that follow the sloughs that are generally at the foot of chert slopes. The surface layer in plowed fields is subsoil material mixed with a small quantity of organic matter. The subsoil and substratum are similar to those of Wolftever silt loam, except that the subsoil is generally slightly thinner. The soil is acid throughout, is moderately low in phosphorus and lime, and is generally low in organic matter and nitrogen. Internal drainage is moderately slow, runoff is relatively rapid, and moisture-holding capacity is moderately high, but practices designed to encourage infiltration of water are desirable.

Almost all of the land is cleared, and corn, hay, and small grains are the crops mostly grown, but about 25 to 30 percent of it is now idle. The soil occurs as narrow strips between the first bottoms and smoother areas of Wolftever soils on the low terraces, and is generally cropped with the adjacent areas of Wolftever silt loam. The aggregate area of 128 acres was mapped mainly in the relatively smooth landscape of the Huntington-Wolftever-Sequatchie soil association. It is a Third-class soil.

The principal management requirements are for maintenance of plant nutrients and control of runoff. As the soil is subject to damage by uncontrolled runoff and the areas are commonly long and narrow, the soil should be kept in hay crops much of the time.

LAND CLASSIFICATION, MANAGEMENT, AND PRODUCTIVITY

PHYSICAL LAND CLASSIFICATION

The units of mapping in the soil survey of Rhea County are classified on the basis of characteristics that can be observed in the field.[13] The fact that soils widely separated in the natural classification may be relatively similar, however, for a particular practical objective raises many problems, the solution of which involves a knowledge of the physical suitability of soils for agricultural use. It is necessary to interpret the characteristics of units of mapping in terms of such suitability if the data of the soil survey are to be useful in the solution of these problems. Interpretations can be made by persons who use the soil survey data for practical objectives, but it is frequently convenient to have the interpretive data definitely presented in the soil survey report.

The soils of Rhea County have been grouped in five classes on the basis of their relative physical suitability for agricultural use under present conditions. In the order of decreasing desirability for agricultural use these are called First-, Second-, Third-, Fourth-, and Fifth-class soils. Although the soils of no one class are ideal for the existing agriculture, the First-class soils more nearly approach that

[13] The method of classification of soils into taxonomic units is described in the section on Soil Survey Methods and Definitions, p. 20.

ideal than Second-class soils. Likewise, the soils of each succeeding class are further from the ideal than are those of the preceding class.

The physical suitability of a soil for agriculture is determined by its characteristics, many of which contribute to its productivity, workability, and conservability. Productivity, as used here, refers to the capacity of the soil to produce crops; the soil may be productive of a crop but not well suited to it because of poor workability, poor conservability, or both. Workability refers to the ease of tillage, harvesting, and other field operations; important among the characteristics that affect workability are texture, structure, consistence, stoniness, and degree of slope. Conservability refers to ease of maintenance or improvement of productivity and workability; the degree to which the soil responds to management practices indicates the extent of the conservation measures that must be practiced.

These three conditions determine the physical suitability of a soil for agricultural use. A soil ideal for agriculture is one that is very productive of a large number of important crops, one that is easily worked, and one that can be conserved with a minimum of effort. All the soils of Rhea County fall short of the ideal, but in widely different degrees. Moreover, the degree of departure of any one of the three conditions from the ideal may differ greatly from that of the other two. For example, a soil may be highly productive and easy to conserve but very difficult to till. The relations among productivity, workability, and conservability are very complex in their influences on the physical suitability of a soil for agriculture. No simple method of evaluating these three conditions and applying the values toward a determination of the physical suitability of the soil for agriculture can be used.

The six relative terms used to describe workability and conservability are excellent, very good, good, fair, poor, and very poor. Soils of excellent workability are generally light- or medium-textured stone-free nearly level soils that require a minimum of effort for tillage and harvesting operations. On soils of very good, good, and fair workability, it is successively more difficult to perform normal farming operations, but as a rule even on soils of fair workability tillage is feasible. Silty clay or clay soils, hilly soils, or soils that contain enough stones to interfere seriously with cultivation, are considered to have fair workability. Soils on which normal tillage operations can be performed only with great difficulty are considered to have poor workability. These soils generally have slopes in excess of 25 percent or are so stony as almost to preclude tillage with ordinary implements. Soils of very poor workability are very steep or very stony, or both, and generally can be tilled only by use of hand implements.

The six terms applied to conservability also are relative, the principal factors being ease of maintaining the content of available plant nutrients at a high level; of controlling runoff and the consequent loss of soil material; and of maintaining good tilth and good conditions for tillage. Excellent conservability means that productivity and workability can be maintained with minimum intensity of management. Very good, good, and fair conservability, respectively, represent soil conditions that require successively more intensive management for conservation of productivity or of workability, or both,

but as a rule both can be conserved under the good management practices that are generally feasible under present conditions for crops that require tillage. Poor conservability of soil used for crops that require tillage represents conditions of such nature that productivity, workability, or both, can be conserved only by intensive management practices that are generally not feasible on most farms under present conditions. Very poor conservability represents the extreme of difficulty of conservation of productivity, workability, or both.

The soils are grouped in five physical land classes on the basis of relative physical suitability for agriculture under present conditions, considering the productivity, workability, and conservability of each soil. It is assumed that under present conditions soils that are only fairly well suited physically both to crops that require tillage and to pasture are better suited to agriculture than soils that are poorly suited to crops but well suited physically to pasture. This assumption is on the basis that soils that are well suited to crops are limiting on more farms than are soils well suited to pasture. If livestock raising should become more important, this assumption might become invalid.

The soils are placed in two groups, in one of which productivity, workability, and conservability are such as to make them at least fairly well suited to crops as well as to pasture; in the other, one or more of these factors make the soils poorly suited to crops that require tillage.

The first group is divided into three subgroups, their limits approximating the concepts of fair and of good cropland. These three subgroups in decreasing order of physical suitability for agriculture are called First-, Second-, and Third-class soils.

The second group, which consists of soils poorly suited to crops that require tillage, is divided into two subgroups, one of which consists of soils at least fairly well suited to the production of permanent pasture; the other, of soils poorly suited to permanent pasture and probably best suited to forest. The first of these two subgroups is called Fourth-class soils; the second, Fifth-class soils.

Information obtained from experiences of farmers, soil surveyors, extension workers, experiment station workers, and others who work with the soil was used in placing the soils in these five physical land classes, after comparing the soils as to productivity, workability, and conservability. For example, a farmer knows that some soils on his farm are physically better suited than others to agriculture. By comparisons of this nature within and among farms the soils have been placed in the approximate order of their physical suitability for agriculture and appear in that order in the table of productivity ratings. The limits selected within this ranking for separation of the soils into the five physical land classes are approximations, and the soils that appear adjacent to each of these limits in the table are marginal between the two classes on either side of the limit.

The five physical land classes are defined in terms of the relative physical suitability of the soils for agriculture under present conditions. Within that definition, however, the ranges of relative physical suitability for crops that require tillage and for permanent pasture are given. The soils are grouped according to the five physical land classes in table 8, in the section on Productivity Ratings (p. 160).

FIRST-CLASS SOILS

The First-class soils, aggregating 2,752 acres, or 1.3 percent of the county, are very good soils for agriculture, and all are well suited physically to most of the exacting and intensive crops commonly grown; they are good to excellent both for crops that require tillage and for permanent pasture. As compared with other soils of the county, all are relatively well supplied with plant nutrients, but even the most fertile is responsive to amendments for some crops. All are well drained, yet their physical properties are such that they retain moisture well. Good tilth is easily obtained and maintained, and the range of moisture conditions suitable for tillage is comparatively wide. The soils are relatively well supplied with organic matter. The physical properties favor normal movement of air and moisture, and roots penetrate the soil easily. None of these soils is characterized by any prominent adverse soil condition; they are almost free of stones, the relief is favorable to soil conservation and tillage, and none is severely eroded or highly susceptible to erosion. Productivity is high for many crops, and the problem of conservation of soil fertility and of the soil material itself is relatively simple under common farmng practices.

SECOND-CLASS SOILS

The Second-class soils, aggregating 27,776 acres, or 21.8 percent of the county, are good soils for agriculture; they are fair to good for crops that require tillage, fair to excellent for permanent pasture, and at least moderately productive of most of the crops commonly grown. Their physical properties are at least moderately favorable for tillage, maintenance of good tilth, and normal circulation and retention of moisture. None occupies slopes greater than 12 or 15 percent, none is sufficiently stony to interfere seriously with tillage operations, and none is severely eroded. Though each soil is moderately deficient in one or more characteristics that contribute to productivity, workability, or conservability, none is so seriously deficient as to render it poorly suited physically to use for crops that require tillage. The deficiencies vary widely: Some soils are fertile, but sloping and moderately eroded; others are almost level and uneroded, but relatively low in content of plant nutrients. Management requirements range widely, because of the many different kinds of soils involved, but the soils of the group are relatively similar in agricultural suitability.

THIRD-CLASS SOILS

The Third-class soils, aggregating 58,532 acres, or 27.3 percent of the county, are fair for agriculture; they are poor to fair for crops that require tillage and fair to very good for permanent pasture. In the case of each soil one or more of the characteristics of workability, conservability, and productivity is so poor that physical suitability for crops that require tillage is definitely limited, though not sufficiently to make the soil poorly suited to such crops. These soils are better suited physically to this use than the Fourth-class soils, but less well suited than the Second-class soils. One or more of the conditions of low content of plant nutrients; low content of organic

matter; low water-holding capacity; undesirable texture, structure, or consistence; strong slope gradient; stoniness; or inadequate natural drainage limit suitability for crops that require tillage. Because of the diversity of characteristics among the soils of this group, the management requirements vary widely.

FOURTH-CLASS SOILS

The Fourth-class soils, aggregating 36,352 acres, or 17.0 percent of the county, are poorly suited to crops that require tillage but are poor to very good soils for permanent pasture; they are poor soils for agriculture mainly because of the limited number of uses to which they are well suited. Some of these soils may be the most important ones on some farms, however, where soils that are well suited to permanent pasture are in great demand. The soils of this group are so difficult to work or to conserve, or both, that management practices necessary for success with crops that require tillage are not feasible on many farms under present conditions. On some farms, however, soils well suited physically to crops that require tillage may be so limiting that it is advisable to practice the intensity of soil management necessary for these crops on Fourth-class soils. They are generally used for pasture on farms where an adequate acreage well suited to crops is available. A considerable area is used for crops, mainly on farms where the acreage of soils better suited to crops is too small to satisfy the needs of the farm unit. The intensity of management on the areas used for crops is generally inadequate for good soil conservation. As on the Third-class soils, management requirements vary widely, both for crops that require tillage and for pasture.

FIFTH-CLASS SOILS

The Fifth-class soils, aggregating 89,088 acres, or 41.6 percent of the county, are very poorly suited to agriculture; they are very poor for crops that require tillage and poor to very poor for permanent pasture. Each is so difficult to work or to conserve or so low in productivity that the intensity of management necessary for its successful use for crops that require tillage is generally not feasible. Each is sufficiently low in plant nutrients or has such poor moisture relations, or both, that common pasture plants produce very little feed. Under present conditions these soils are apparently best suited to forest or similar uses. Local conditions may require the use of some of the soils of this class for pasture or for crops despite the fact that they are poorly suited to such uses. A few soils, as Apison very fine sandy loam, severely eroded rolling phase, have been used successfully for crops by a few farmers who have applied special systems of management.

ASSOCIATIONS OF PHYSICAL LAND CLASSES

A large number of interpretive maps can be derived from the data of the detailed soil map, which shows the areal extent and geographic distribution of the soils and land types of the county. The units of mapping must be interpreted, however, in the light of available information about them in order that the map may be of use for

practical objectives. One kind of interpretive map, given in figure 18, is designed to aid in visualizing the general physical capability of large areas for agriculture. Each kind of area is relatively uniform with respect to the proportionate areal extent of soils of similar physical capability for agriculture under present conditions; and each has a relatively consistent manner of association of soils of different physical capability. For example, in areas of association C, Third- and Fourth-class soils are dominant, and they are associated in most places in such manner that long narrow areas of Third-class soils are surrounded by land and slightly broader areas of Fourth-class soils. The more common variations from this manner of association are noted in the description of the association.

Association A is dominated by soils that are good to excellent for the agriculture of the county. Between 65 and 95 percent of each area is at least fairly well suited physically both to the production of crops that require tillage and to pasture, and more than half this part is physically good cropland. Less than 10 percent of any area of the association is poorly suited physically both to crops that require tillage and to pasture. Between 0 and 25 percent of each area is poorly suited to crops that require tillage but is fairly well suited physically to permanent pasture.

Soils well suited physically to the production of crops that require tillage occur in broad areas of large uniform-shaped fields, which can generally be laid out without including soils poorly suited physically to crop production. The quality of these soils varies from place to place, but there is a higher proportion of good and excellent soils for crops than in other areas of comparable size. On most general farms the soils well suited to crops are in excess of the requirements of the farm units for cropland, and part of such soil is commonly used for pasture.

In general this association represents the best agricultural land. A very large part of each area is well suited physically to many different crops, and relatively large parts of most farms on it are not limited seriously by poor physical suitability for the choice of crops. Generally, there are deficiencies in suitability for some crops within farm units, but most farmers have greater freedom of choice of land for various uses than in other areas. Although the physical suitability for use of a large part of this association varies within relatively narrow limits, the management requirements of soils that make up that part may vary within relatively wide limits; and farmers in different places on this association may need to use different management practices to attain similar objectives.

Areas of association A are mainly on the Talbott-Allen-Lindside. Sequatchie, Talbott-Colbert-Waynesboro, and Huntington-Wolftever-Sequatchie soil associations described in the first part of the section on Soils. (See fig. 4, p. 36.) They occupy almost all the Talbott-Allen-Lindside and Huntington-Wolftever-Sequatchie associations, and a large part of the Sequatchie and Talbott-Colbert-Waynesboro associations. On the Sequatchie association, they are on areas dominated by Sequatchie fine sandy loam; on the Talbott-Colbert-Waynesboro association, on areas dominated by Talbott soils or by Waynesboro and other soils of the terraces.

Practically all this association is used for crops or for pasture. The part on the Huntington-Wolftever-Sequatchie soil association is commonly cropped mainly to corn and hay. The parts on the other soil associations are commonly used for corn, small grains, hay, or pasture. A fairly large acreage of that part on the Talbott-Allen-Lindside association is used also for vegetables. Much of association A has been inundated by waters of the Chickamauga Reservoir, and most of the inundated areas are on the Huntington-Lindside-Sequatchie and the Sequatchie associations.

Association B differs from association A mainly in the quality of soils at least fairly well suited physically to crops that require tillage. The two associations are relatively similar in the proportions of (1) soils at least fairly well suited physically to crops, (2) soils poorly suited to crops but at least fairly well suited physically to pasture, and (3) soils poorly suited both to crops and to pasture. The soils that are at least fairly well suited physically to crops, however, are dominantly fair cropland in contrast with a similar proportion of good cropland in association A.

Between 65 and 95 percent of each area of this association is physically fair to excellent cropland, and more than half this part is physically fair cropland. Less than 10 percent of any area is poorly suited both to crops that require tillage and to pasture. Less than 25 percent is poor cropland but at least fairly well suited physically to permanent pasture.

The soils that are at least fairly well suited physically to crops that require tillage generally exist in broad areas, so that large uniform-shaped fields can be laid out without including soils poorly suited to crops. The quality of these soils varies from place to place, but they are dominantly only fairly well suited physically to crops that require tillage. On most general farms the acreage of these soils is in excess of the requirements of the farm units for cropland and parts of them are commonly used for pasture. The cropland on some farms of this association is as desirable as that on most farms in association A, but on the majority it is definitely inferior to the cropland of association A.

In general this association includes some of the better agricultural land, but its suitability for agriculture is generally conditioned by more exacting management requirements than on soils of association A.

Association B occupies a small part of the Hartsells-Muskingum soil association, a relatively large part of the Talbott-Colbert-Waynesboro association, and small parts of the Conasauga and Clarksville-Fullerton associations. (See fig. 4, p. 36.) The part of the Hartsells-Muskingum association in association B is composed almost entirely of Hartsells and Crossville soils. That on the Talbott-Colbert-Waynesboro association is composed mainly of the better types and phases of Colbert soils, the poorer phases of Talbott, Waynesboro, Cumberland, Etowah, and Wolftever soils, and soils such as those of the Taft and Philo series. The part of the Conasauga association in association B is an area where the better phases of Conasauga soils are concentrated in association with smaller acreages of the poorer phases of Cumberland and similar soils. The part of the Clarksville-Fullerton association in association B consists of areas in

which the better phases of the Clarksville and Fullerton soils, some Dewey soils, and considerable acreages of Greendale soils are concentrated.

Management requirements of the soils that constitute this association vary widely among farms and within farms. The factors that limit the suitability of the soils for agriculture are different on different parts of the association. Farmers generally are not limited seriously by the physical suitability of the soils in the choice of crops, but management requirements are commonly more exacting than on most soils of association A. Most of the association is cleared and used for crops that require tillage or for pasture.

Association C differs from associations A and B in that it has a much smaller number of soils that are physically fair to good cropland and a much larger acreage of soils that are poor cropland but physically at least fair pasture land.

Between 25 and 65 percent of each area is at least fairly well suited physically to crops that require tillage, and in most areas more than half of this part is physically only fair cropland. Between 25 and 65 percent of each area is poorly suited to crops that require tillage but is at least fairly well suited physically to permanent pasture. In most areas very little soil is poorly suited both to crops that require tillage and to pasture, but in a few places these soils may constitute as much as 30 percent of the association.

Most of this association is in the Clarksville-Fullerton soil association, but a few large areas are on the Talbott-Colbert-Waynesboro association and smaller areas are on the Jefferson-Clarksville-Upshur, the Talbott-Allen-Lindside, and the Muskingum-Apison associations. (See fig. 4, p. 36.)

The pattern of soils on the part in the Clarksville-Fullerton soil association is distinctive. The better phases of Clarksville and Fullerton soils, which are physically fair cropland, are in long, narrow, crooked areas surrounded by the poorer phases of the same soil series. As a consequence, fields of cropland are generally small and irregular in shape and commonly contain considerable parts of soil that are poorly suited to crops that require tillage. The cropland is generally of moderate to low quality. Much of this part of the Clarksville-Fullerton association has been cleared, but, unlike the part in association B, a large part of the cleared land is idle. General farm crops and truck crops are grown. Corn, lespedeza, small grains, beans, and peas are the more common general farm crops, and strawberries the principal truck crop.

The part of association C in the Talbott-Colbert-Waynesboro soil association has a somewhat different pattern. Soils that are physically fair to good cropland are generally in relatively broad areas interspersed by equally broad areas of soils that are poor cropland but fair to good pasture land. As a result of this soil pattern, some farms have as high a proportion of fair cropland as most farms in association B; others have little or none. The quality of the soils varies more among farms than on the part in the Clarksville-Fullerton association.

The patterns of soils vary considerably in the other soil associations. On the Muskingum-Apison and Jefferson-Clarksville-Upshur associations areas of association C generally contain long narrow areas of Fifth-class soils that may constitute as much as 30 percent of the total.

Farms on this association are commonly deficient in soils physically well suited to crops that require tillage. Management requirements for good production of crops on most of the soils are relatively exacting, but the soils are commonly responsive to good management.

The agriculture on association C is generally not prosperous, except to some extent on some farms where farm and soil management have been adjusted to the requirements of existing conditions. It is probable that greater improvement in such adjustment can be made on areas of this association than on most other areas of the county.

Association D is similar to association C in the relative acreage of soils physically at least fairly well suited to crops that require tillage, but it contains a much higher proportion of soils poorly suited both to crops that require tillage and to permanent pasture. Between 25 and 65 percent of each area is at least fairly well suited and between 30 and 70 percent of each area is poorly suited physically both to crops that require tillage and to pasture. A very small part of most areas is physically poor cropland but fair to good pasture land.

Most of association D is on the Hartsells-Muskingum soil association, of which it constitutes the major part. (See fig. 4, p. 36.) Smaller areas are on the Sequatchie, Muskingum-Apison, Conasauga, and Clarksville-Fullerton associations. It is characterized on all soil associations by narrow to broad areas of Third-class soils bounded on most sides by equally broad areas of Fifth-class soils. In some places the areas of Third-class soils are large enough to supply an adequate acreage of fair cropland for most farms. In other places the areas of Third-class soils are long and narrow and are isolated by areas of Fifth-class soils. Such parts of the association are commonly in forest.

Some areas of association D on the Hartsells-Muskingum soil association are cleared and used for general farm crops, including corn, lespedeza, small grains, and soybeans. Truck crops, as potatoes, sweetpotatoes, and beans are also grown. Much of the area is forested, and a considerable acreage of this forested area can probably be considered potential agricultural land. The soils suitable for tillage are generally low in fertility but are easily conserved and easily tilled. They are responsive to good management.

Areas of association D on the Muskingum-Apison soil association are characterized by concentrations of Apison soils. They contain more Fourth-class soils than do areas on the Hartsells-Muskingum association. Areas on the Clarksville-Fullerton association are characterized by the dominance of steep Clarksville or Fullerton soils. The soils fairly well suited to crops that require tillage generally exist in small areas on these two soil associations. The association of physical land classes in these places is rather poorly suited to agriculture, although some areas are cleared and cultivated.

Areas on the Conasauga soil association are characterized by moderately broad areas of Conasauga silt loam and Conasauga silty clay loam, eroded phase, surrounded by broad areas of severely eroded Conasauga soils or rough gullied land. These areas are probably the most seriously eroded large areas in the county. The fair cropland that remains requires very careful management, but under good management it can be conserved in agricultural use and will produce moderately well. There is a serious problem of reclamation. Much of the land has been cleared, but a large part is idle.

The part of association D on the Sequatchie soil association consists mainly of moderately large areas of Sequatchie soils surrounded by stony colluvium. Areas of Sequatchie soils are fairly well suited physically to cultivation and are better suited to truck crops than to most of the general farm crops.

Association E consists almost entirely of soils poorly suited both to crops that require tillage and to pasture. On a few areas as much as 30 percent of the association may be at least fairly well suited physically to permanent pasture, or as much as 15 percent to crops that require tillage. No area is less than 65 percent poorly suited both to cultivation and pasture.

The Muskingum soil association is entirely in association E. Most of the Muskingum-Apison soil association, smaller parts of the Jefferson-Clarksville-Upshur association, and one small area of the Clarksville-Fullerton association are also included. (See fig. 4, p. 36.)

Almost the entire area of association E is forested, and probably its best use in most places is for forest.

LAND USE AND SOIL MANAGEMENT[14]

The purpose of this section is to explain briefly some of the principles of good soil management and to assemble in one place a record of the major management requirements. Most of the common management practices and requirements are discussed in the section on Soils for each soil type also.

In the first part of this section, it is pointed out that good soil management involves maintenance of an even and adequate supply of water in the soil for the use of plants and such other adjustment as enable plants to make efficient use of the water. In the second part, practices are suggested for groups of soils of relatively similar management requirements that may aid in maintaining an even and adequate supply of moisture in the soil and so adjust other conditions that plants can make efficient use of the moisture. This part of the section is to be used as a supplement to the definition of good management for columns C of the tables of estimated yields and of productivity ratings (pp. 153 and 160).

Land use, as used here, refers to broad use groups: (1) For crops that require tillage, (2) for permanent pasture, and (3) for forests. Soil management refers to such practices as (1) choice and rotation of crops, (2) application of soil amendments, as lime, commercial fertilizer, manure, and crop residues, (3) tillage practices, and (4) engineering practices for the control of water on the land.

In reading this section it should be recognized that the farmer who attempts to readjust the use and management of his soils is confronted with a number of problems, over some of which he has no control. Among the factors to be dealt with are (1) the size and type of farm; (2) the physical character of the land, including the pattern of soils on the farm; (3) the surrounding social and economic conditions, as transportation, market, church, and school facilities; (4) the immediate demand for a cash income to meet taxes, indebtedness, support of family, and other expenses; (5) the relation between prices of farm products and other commodities; (6) the

[14] This section was prepared by M. G. Cline, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

farm operator's facilities and resources for operating purposes, including buildings, equipment, seed, kind and number of livestock, cash, credit, and other items; (7) the farm operator's ability, preferences, and other characteristics; (8) community cooperation with respect to drainage, water disposal, marketing, buying, and other operations; and (9) miscellaneous factors, as farm tenure, labor conditions, and health.

The farmer as an individual has full or partial control over some of these factors but little or no control over others. A full solution requires individual-community-State-national action, embracing all the problems and influences that affect agriculture. A farmer, as an individual, can make only those adjustments toward better management that are possible within his limited financial and personal ability. It is recognized that certain of the management practices suggested for the various soils may not be feasible for many farmers under present conditions. Some may attain the same objective by the use of combinations of management practices different from those indicated and better suited to their particular conditions.

WATER CONTROL ON THE LAND

Water control on the land consists of practices having to do with the maintenance of soil-moisture conditions favorable for the growth of a particular crop or group of crops and with the regulation of runoff. These practices may be grouped as follows: (1) Control of too rapid runoff, (2) protection from floods, (3) drainage, and (4) irrigation.

In Rhea County, irrigation is at present of little or no importance, although it doubtless would increase production of crops on many soils in dry seasons. Its use to supplement rainfall might prove economically feasible under some conditions, especially on vegetable gardens and on other small areas of high-value crops.

Little has been done in the county to protect areas from floods, although considerable damage is done occasionally by the overflow of streams. Most floods occur early in spring before crops are on the land, and flooding is not so serious a problem as on areas farther from the sources of the Tennessee River.

Artificial drainage of some areas of poorly drained soils has been accomplished by open ditches. Little tiling has been done. Drainage is not a serious problem on most farms of the county, but it would improve the soils of some areas.

Control of rapid runoff is the problem of major importance in water control. Almost all parts of the county contain some rolling, hilly, or steep land from which water flows more rapidly than is desirable.

In the area of the Tennessee Valley, of which Rhea County is a part, a series of dams (fig. 19) has been constructed to control and use the water in the streams for the benefit of the people. These dams make waterways for navigation possible, decrease floods by regulating the volume of flow, and provide a head of water for the production of electrical energy. Their effectiveness is dependent to a large extent on their capacity to regulate the volume of flow of the large streams. The streams of Rhea County are feeders of the Tennessee River, and any measures that regulate the flow of water from the land they drain has

545846—48——9

a bearing on the effectiveness of the entire system of dams farther down the river. Moreover, the principal means of controlling floods on these feeder streams is through the control of water on the land where it falls.

Water is a natural resource to be exploited on the land as well as in the streams. It is necessary for the growth of plants, and even in a region of high rainfall, such as Rhea County, lack of water is commonly a limiting factor in the growth of plants during certain periods of the year. Any measures that result in a more adequate and even supply of water during the growing season will promote increased production of the plants on which the people on the land depend for their livelihood.

The control of runoff therefore is important from the standpoint of all who live in the watershed, and to varying degrees from the standpoint of all who are affected by the social and economic conditions there.

There may be two direct results of too rapid runoffs on the soil as a medium for the growth of plant—loss of water and loss of soil. Loss of water always results; loss of soil material may or may not accompany it. Of the two, the loss of soil material is the more apparent, because it leaves the soil in an eroded condition and its apparent effects are generally cumulative. It is not a thing to be corrected by itself, however, because the losses of water and of soil material are too intimately associated in their causes, in their effects one on the other, and in the practices designed for their control that they logically cannot be treated separately. The conservation of both is based on the control of runoff.

The effective use of water by plants is conditioned by other factors of crop production that may be limiting. If the water that falls on the land is to be used effectively by crop plants, the soil must be used for plants to which it is suited, water must remain in the soil in quantities sufficient for the needs of the plants, an adequate supply of plant nutrients must be available, the physical condition of the soil must be suitable for the root systems of the plants, and insects, diseases, and weeds must be controlled. These are the principles upon which good soil management is based. They are also the principles upon which control of runoff is based. Control of runoff is a part of good soil management, but the practices that make it possible include most of the practices that are necessary for good soil management.

Runoff is retarded by vegetation in proportion to the denseness of the cover and the tendency of the vegetation to induce a soil condition that favors absorption and retention of water. In addition, the vegetative cover, its root system, and its debris decrease the loss of soil material in the runoff that does occur by reducing the rate and by binding the soil particles. Forests are very effective in this respect; hay and pasture grasses, legumes, and other sod-forming plants are also effective. Small grains and other close-growing crops are somewhat less effective, and intertilled crops are generally least effective.

Different soils that have similar slopes are not equally subject to rapid runoff, but the quantity and rate of runoff increase with an increase in the slope of soils that are similar in other respects. In general, crops that retard runoff effectively should be grown more of the time on the steeper than on the less steep phases of the same soil type.

FIGURE 19.—Watts Bar Dam and hydroelectric plant, one of the multiple-purpose Tennessee V
Tennessee River. About 8,700 acres of this reservoir and about 4,400 acres of Chickam
County. The two reservoirs with the navigation locks afford waterway facilities for boat

The very steep phases of a given soil type should be used as far as practicable for forests; the less steep phases should be used for pasture; still less steep phases, for close-growing crops; and only the gently sloping phases, on which runoff is not rapid, should be used frequently for intertilled crops. Crop rotations should be so adjusted that the more steeply sloping soils under cultivation are in sod-forming crops as much of the time as is feasible in good farm management, but the steepness of soils that are well suited physically to a particular rotation varies among the soil types.

If the vegetative cover is to be effective, it should be vigorous in growth. To that end, suitable applications of lime, manure, and fertilizer and the use of legumes in the rotation are management practices that will help control runoff. Agricultural lime supplies the plant nutrient calcium and adjusts the acidity of the soil. Manure supplies nitrogen, potash, and organic matter and aids in maintaining the soil in good physical condition. Mineral fertilizers may be used to supply nitrogen, phosphorus, and potash and minor nutrient elements. Legumes fix nitrogen from the air, if properly inoculated, and their root systems add organic matter and aid in maintaining a good physical condition of the soil. The use of these practices promotes vigorous growth of crops in the rotation, which is desirable from the standpoint not only of control of runoff but also of effective use of water in the production of crops.

The soil should be tilled in such manner that it will be in condition to retard runoff and absorb water. Tillage should be at such times and in such manner that the soil will be bare of vegetation as little of the time as feasible. Contour tillage is desirable on many slopes to retard the rate of runoff. Contour strip cropping may be desirable on the steeper slopes and it is generally most feasible and most desirable on long slopes.

Engineering methods of water control, such as terracing, are commonly expensive. Terracing leaves many soils in such condition that considerable effort may be required to restore them to high productivity. The terraces also require maintenance to be effective, and unmaintained terraces may be worse than none. Such practices have a place in water control under certain conditions, but they are generally to be resorted to only where effective control of rapid runoff cannot be accomplished by other methods that consist essentially of good soil management for good production.

Like all other management problems, the best method for the control of too rapid runoff depends not only on the soil but also on the particular conditions that exist within each farm unit. Each farmer should choose the particular combination of practices that fulfills the requirements of his farm business and provides the maximum control of runoff within the feasible limits of his operations. He should choose those practices that provide not only good control of runoff but also the proper medium for the growth of plants and the plant nutrients necessary for effective use of the water he conserves. Effective control of runoff is obtained on many farms in Rhea County and can be obtained on many more by the use of those management practices that would ordinarily be considered sound from the standpoint of efficient production.

It will be noted from the foregoing discussion that the control of too rapid runoff is not an isolated problem. It involves all the practices of good soil management that would ordinarily be considered for successful crop production. Control of runoff is a part of successful crop production; it can be accomplished largely through good farming practices, including the proper choice and rotation of crops, proper fertilization, proper tillage, control of insects, pests, and diseases, and in some places, the use of engineerinig methods.

In the second part of this section the soils of the county are grouped according to similarities of management requirements; and the management requirements of the soils of each group are discussed from the standpoint of practices that not only will aid in keeping the water in the soil in quantities suitable for good production of crop plants but also will enable the plants to make effective use of the water that is in the soil.

LAND USE AND SOIL-MANAGEMENT REQUIREMENTS

In this subsection the practices that aid in maintaining an even and adequate supply of moisture for plant growth and that adjust other soil conditions so that plants can make efficient use of the water are discussed for groups of soils that have relatively similar management requirements. This part of the report is to be used for the definition of good management for columns C of the tables of estimated yields and productivity ratings (pp. 153 and 160) as well as for information on the management requirements of soils.

A particular use of soils must be assumed as a basis for discussion of their management requirements. These vary among different uses of the same soil as well as among different soils in the same use. The management requirements of soils of each group are discussed with respect to two broad uses, crops that require tillage and permanent pasture.

Management requirements on the same soil vary among crops that require tillage, and they are discussed for these crops in terms of a rotation or rotations considered to be well suited to the soils. The management of the soil for one crop of the rotation generally has an effect on the successful production of other crops in the rotation. Management requirements of the soil for each crop are, therefore, dependent not only on the characteristics of the soil and of the crop but also on the management that has been practiced on other crops of the rotation.

Experimental data on which to base recommendations for the use or management of many of the soils of Rhea County are very meager; and recommendations for best use and best management of a soil in a particular place involve consideration of so many conditions on the particular farm that they cannot be made in a general discussion of soils of an area as large as Rhea County. Consequently, the material in this section is limited to a discussion of the deficiencies of soils, in order that persons who have the other necessary information may interpret them into recommendations for particular areas.

Management practices desirable under conditions on many farms in the area are therefore suggested to serve as a guide in interpreting the information to fit the conditions on individual farms. The practices represent one or more particular kinds of management, but many dif-

ferent combinations in various intensities of application can be used in most cases to attain the same production objective. Proper choice depends upon conditions of the farm as a unit. For example, nitrogen may be maintained by the use of legumes, manure, or commercial fertilizers or combinations of the three. The best method for maintaining nitrogen depends on the farm as a business as well as on soil conditions.

Although each soil probably has individual requirements for certain good management practices, some have management requirements in common. Soils that have many management requirements in common have been grouped in this section for convenience of discussion and reference. Soils of each of the 17 groups discussed are listed in table 6.

TABLE 6.—*Groups of soils of Rhea County, Tenn., with similar management requirements and similar conservability of plant nutrients, soil material, and tilth*

Soil-management group	Soil	Conservability [1] of—			Physical land classification
		Plant nutrients [2]	Soil material	Tilth	
1	Abernathy silt loam	Excellent	Excellent	Excellent	1
	Huntington silt loam	do	do	do	1
	Huntington fine sandy loam	Good	do	do	2
	Lindside silt loam	Excellent	do	Very good	2
	Ooltewah silt loam	do	do	do	2
2	Ooltewah fine sandy loam	Good	do	Excellent	3
	Philo fine sandy loam	Fair	do	do	3
	Philo silt loam	do	do	do	3
	Pope fine sandy loam	do	do	do	2
	Pope silt loam	do	do	do	2
	Roane gravelly silt loam	do	do	do	2
	Roane silt loam	do	do	do	3
	Sequatchie fine sandy loam	do	do	do	2
	Staser loamy fine sand	Good	do	do	3
	Taft silt loam	Fair	do	Good	3
3	Egam silty clay loam	Excellent	do	Fair	2
	Lindside silty clay loam	do	do	do	3
4	Burgin clay loam	Very good	do	Poor	4
	Dunning silty clay loam	Excellent	do	do	4
	Melvin silt loam	do	do	Fair	4
5	Atkins silt loam	Fair	do	Good	4
	Atkins very fine sandy loam	do	do	Very good	4
	Guthrie silt loam	Good	do	Fair	4
	Robertsville silt loam	Fair	do	do	4
6	Cumberland silty clay loam, eroded phase	Good	Good	Good	2
	Dewey silt loam	Very good	Very good	Very good	1
	Dewey silty clay loam, eroded undulating phase	Good	Good	Good	2
	Emory silt loam	Very good	Very good	Very good	1
	Emory silty loam, sloping phase	do	Good	do	2
	Etowah silt loam	do	do	do	1
	Etowah silty clay loam, eroded phase	Good	do	Good	2
	Talbott silt loam	do	do	do	2
	Wolftever silt loam	do	Very good	do	2
7	Cumberland silty clay loam, eroded sloping phase	do	Fair	do	2
	Dewey silty clay loam, eroded phase	do	do	do	2
	Etowah silty clay loam, eroded sloping phase	do	do	do	2
8	Cumberland silty clay loam, severely eroded sloping phase	Fair	Poor	Fair	4
	Dewey silty clay loam, eroded hilly phase	Good	do	Good	3
	Talbott silty clay loam, eroded phase	do	do	Fair	3
	Wolftever silty clay loam, eroded sloping phase	Fair	do	do	3
9	Allen very fine sandy loam	do	Very good	Very good	2
	Cumberland gravelly fine sandy loam	Good	do	do	2
	Fullerton cherty silt loam, undulating phase	Fair	do	do	2
	Fullerton silt loam	do	do	do	2
	Greendale silt loam	Good	do	do	2
	Waynesboro fine sandy loam	do	do	do	2
	Waynesboro gravelly fine sandy loam	do	do	do	2

[1] Expressed in relative descriptive terms, assuming use for crops that require tillage, as follows: (1) Excellent, (2) very good, (3) good, (4) fair, (5) poor, and (6) very poor.

[2] Conservability of plant nutrients, if soil material is to be conserved.

TABLE 6.—*Groups of soils of Rhea County, Tenn., with similar management requirements and similar conservability of plant nutrients, soil material, and tilth*—Continued

Soil-management group	Soil	Conservability of— Plant nutrients	Soil material	Tilth	Physical land classification
10	Allen stony fine sandy loam, eroded phase	Fair	Fair	Good	4
	Allen very fine sandy loam, eroded sloping phase.	do	do	do	3
	Cumberland gravelly fine sandy loam, eroded sloping phase	Good	do	do	3
	Fullerton cherty silt loam	Fair	Good	Very good	3
	Eroded phase	do	Fair	Good	3
	Greendale cherty silt loam	do	Good	Very good	3
	Waynesboro fine sandy loam, eroded sloping phase.	Good	Fair	Good	3
	Waynesboro gravelly fine sandy loam, eroded sloping phase	Fair	do	do	3
11	Apison very fine sandy loam, eroded rolling phase	do	Very poor	Fair	4
	Cumberland gravelly fine sandy loam, eroded hill phase.	Good	Poor	do	4
	Dewey silty clay loam, severely eroded hilly phase.	Fair	Very poor	Poor	4
	Fullerton cherty silt loam.				
	Hilly phase	do	Poor	Fair	4
	Eroded hilly phase	do	do	do	4
	Severely eroded phase	Poor	do	Poor	4
	Upshur silt loam, hilly phase	Fair	do	do	4
	Waynesboro gravelly fine sandy loam, eroded hilly phase	do	do	Fair	4
12	Clarksville cherty silt loam, undulating phase.	Poor	Very good	Very good	3
	Crossville loam	do	do	do	2
	Hartsells fine sandy loam	do	do	do	2
	Holston very fine sandy loam	do	do	do	3
	Jefferson stony fine sandy loam	do	do	do	3
	Jefferson very fine sandy loam	do	do	do	2
	Nolichucky fine sandy loam	do	do	do	3
	Pope loamy fine sand	Very poor	do	do	4
13	Clarksville cherty silt loam	Poor	do	do	3
	Eroded phase	do	Fair	Good	3
	Crossville loam, rolling phase	do	Good	Very good	3
	Hanceville fine sandy loam	do	do	do	3
	Hartsells fine sandy loam				
	Rolling phase	do	do	do	3
	Eroded rolling phase	do	Fair	Good	3
	Holston gravelly fine sandy loam	do	do	do	3
	Jefferson very fine sandy loam, eroded sloping phase	do	do	do	3
	Jefferson stony fine sandy loam, eroded sloping phase	do	do	do	4
	Nolichucky fine sandy loam, eroded sloping phase.	do	do	do	3
	Sequatchie loamy fine sand	Very poor	Very good	Excellent	3
14	Clarksville cherty silt loam				
	Hilly phase	Poor	Poor	Good	4
	Eroded hilly phase	do	do	do	4
15	Apison very fine sandy loam	Fair	Fair	do	2
	Eroded phase	do	Poor	do	3
16	Colbert silt loam	Good	Fair	Fair	3
	Deep phase	do	Good	Good	2
	Colbert silty clay loam, eroded phase	do	Poor	Very poor	4
	Conasauga silt loam	do	Fair	Fair	3
	Upshur silt loam	do	do	do	3
17	Colbert silty clay loam, eroded rolling phase	do	Very poor	Very poor	4
	Conasauga silty clay loam, eroded phase	do	Poor	do	4
	Rolling stony land (Colbert soil material)	do	Very poor	do	4
	Upshur silty clay loam, eroded phase	do	Poor	Poor	3

The conservability of plant nutrients, soil material, and good tilth of each soil are given in table 6 to indicate some of the conditions that contribute to the management requirements that the soils of each group have in common. Six relative descriptive terms are used for each condition as follows: (1) Excellent, (2) very good, (3) good, (4) fair, (5) poor, and (6) very poor. All refer to conservability

under use for crops that require tillage. The terms are purely relative and characterize the intensity of management necessary to conserve the constituent or condition indicated. For example, excellent conservability of plant nutrients means that plant nutrients can be maintained at a high level for the production of crops that require tillage by means of these management practices that are the least intensive of any necessary for maintaining a high nutrient level in the soils. Poor conservability of plant nutrients indicates the necessity of intensive management practices for maintaining a high level of plant nutrients for crops that require tillage. Inasmuch as plant nutrients are a part of the soil material, the terms are used to describe conservability of plant nutrients, assuming that accelerated erosion is to be controlled.

Table 6 emphasizes the fact that the soils vary widely in management requirements within physical land classes. Soils may be similarly suitable physically for agriculture, but the management practices necessary to attain and maintain that suitability may be quite different because the deficiencies of the soils are different. The table also emphasizes the fact that soils of similar management requirements may have different physical suitability for agriculture. Soil characteristics that have little influence on management requirements for a particular use may have a great influence on the physical suitability of the soil for that use. For example, stoniness may have a greater influence on the physical suitability of a soil for crops that require tillage than it has on the management requirements of the soil for those crops. In most cases, however, the soils of each management group are not widely separated in physical suitability for use in the present agriculture.

Only soils of the first four physical land classes are discussed with respect to management requirements. Fifth-class soils are so poorly suited both to crops and to pasture that it is not considered necessary to suggest management requirements for those uses, feasible management practices generally will not materially increase their normally low productive capacity either for crops that require tillage or for pasture.

SOIL GROUPS

The following groups of soils are based on similarities of management requirements for crops that require tillage. To avoid a second grouping, management requirements for permanent pasture as well as for crops that require tillage are discussed for each group. Generally, management requirements for permanent pasture also are similar among the soils of each group. The soils of different groups may also have similar management requirements for pasture, although they have striking dissimilarities of management requirements for crops that require tillage. This arises from the more exacting management requirements that result from the tillage of most of these soils.

GROUP 1

The soils of group 1 are fertile and easily worked and for the most part are generally not appreciably subject to accelerated erosion. They are the soils best suited to intensive and continuous cropping. Their relief is nearly level, and they exist on first bottoms or in depressions of the upland and receive deposition of alluvial ma-

terial periodically. They have a relatively high content of organic matter and plant nutrients, constituents that are added to the surface periodically by flooding. Their physical condition is very good for the maintenance of good tilth and for normal retention and movement of water in the upper parts of the soil. External drainage is slow; internal drainage is relatively rapid in the Huntington and Abernathy soils and is medium slow in the Lindside and Ooltewah soils. The soils are subject to inundation in spring and during periods of high rainfall and are not so well suited to perennial and winter annual crops as are most soils of the well-drained uplands. They are exceptionally well suited to corn, to red clover, timothy, and other hay crops, and to pasture but not so well suited to small grains because of their tendency to lodge. Huntington fine sandy loam is generally the least fertile of the group and the first to become suitable for tillage in spring. It is particularly well suited to certain vegetables. Lindside silt loam and Ooltewah silt loam are the last to become suitable for tillage in spring and present some problems of drainage.

These soils can be used for intertilled crops each year and will maintain production at a high level for considerable periods without amendments, although precautions to maintain the content of plant nutrients and organic matter generally increase production. Corn followed in fall by a cover crop, such as crimson clover or hairy vetch, to be plowed under as green manure in spring, is considered a good cropping system. Production can be maintained at a relatively high level without amendments under such cropping, but the yield of corn can be increased considerably by light or moderate applications of potassium and phosphorus to the cover crop.

Late-planted vegetables do well on these soils, particularly on the Huntington and Abernathy. Huntington fine sandy loam is especially well suited to these crops. It dries earlier in spring than Huntington silt loam. Vegetable crops followed by a leguminous winter cover crop that is turned under in spring produce well each year if well managed in other respects. Experience in other areas indicates that such crops respond well to heavy applications of complete fertilizer.

No special practices of tillage or cropping are necessary for the control of too rapid runoff on these soils. There is some danger of scouring during floods on the Huntington and Lindside soils, and for this reason it is advisable to plow in spring rather than in fall. Artificial drainage would improve the Lindside and Ooltewah soils for most crops, but lack of proper outlets makes it generally difficult to establish.

Permanent pastures are very good without special management practices on these soils. Phosphorus is the principal plant nutrient that may be limiting. Pastures should be grazed or clipped closely at regular periods to favor the growth of leguminous plants at the expense of grasses. Heavy grazing is generally less harmful than undergrazing to pastures on these soils.

GROUP 2

Management of the soils of group 2 differs from that in group 1 principally in problems arising from the greater difficulty with which plant nutrients are maintained at a high level. These are well-drained

or imperfectly drained soils of first bottoms, low terraces, and depressions. All except Sequatchie fine sandy loam and Taft silt loam receive deposition periodically. Compared with soils of group 1, all are moderately low in nitrogen, phosphorus, and potash, and all except Staser loamy fine sand are low in lime. None is subject to appreciable accelerated erosion except by scouring during floods. All except Taft silt loam have highly desirable physical conditions for the maintenance of good tilth. The Pope, Sequatchie, Staser, and Roane soils are well drained; but the Ooltewah, Philo, and Taft soils imperfectly.

Most of these soils are at least moderately well suited physically to vegetables, corn, and hay crops, but generally not so well suited to perennials or winter annuals as to corn or hay, although small grains are fairly productive under good management. Practices that aid in maintaining the content of organic matter and plant nutrients at levels adequate for good production should receive first consideration.

Intertilled crops, such as vegetables or corn, can be grown successfully year after year on most of these soils if other management requirements are met. Taft silt loam is rather poorly suited to such cropping system. It is generally advisable to grow a winter-legume cover crop, such as crimson clover or hairy vetch, after an intertilled crop to aid in the maintenance of organic matter and nitrogen. The soils, except Staser loamy fine sand, are acid, and moderate applications of lime at relatively short intervals should be made for good results in such a cropping system. Heavy applications of a complete fertilizer that carries a relatively high proportion of nitrogen and potash have given good results for vegetable crops on these soils in other areas. Most of the nitrogen and organic matter necessary can be obtained from the cover crop if it is turned under in spring as a green manure. It may be desirable to apply lime under the cover crop and phosphorus and potash under the vegetable crops, and to depend upon the residual effects of each for the crop to follow. Manure is especially beneficial, and where it is applied the quantity of nitrogen and potash in commercial fertilizers used may be reduced with good results.

A common rotation of field crops and one that appears to be well suited to these soils is corn followed by small grain to be harvested in spring and lespedeza to be harvested the following fall. Moderate applications of lime under the small grain-lespedeza seeding would benefit the crops of the rotation, and a moderate application of potassium and phosphorus once in the rotation should prove beneficial. Manure is highly beneficial and can replace part of the potash of commercial fertilizer. Red clover and timothy or orchard grass can replace the lespedeza in the same rotation, and alfalfa can be used in a longer rotation on the well-drained soils of this group, but it requires heavier applications of lime and potassium than the other hay crops suggested. Frequent moderate applications of fertilizer are more desirable on these soils than heavy applications at long intervals. Liming is generally not necessary on the Staser soil, and it may not be necessary on some areas of Ooltewah fine sandy loam.

Unless adequately fertilized, pastures on these soils generally consist of relatively undesirable plants. Moderate applications of lime and phosphorus every 3 or 4 years are desirable. Potassium may be

supplied in adequate quantities if droppings are scattered, but if potash is deficient it may have to be supplied from commercial sources. Very close grazing is more harmful on these soils than on soils of group 1, but undergrazing also should be avoided. Clipping the pastures should aid in controlling weeds and encourage the growth of white clover.

No special practices of tillage or cropping are necessary for the control of runoff, but soils of the first bottoms may scour during floods and should be plowed in spring instead of fall unless a cover crop is grown. Artificial drainage would improve the Philo, Ooltewah, and Taft soils, but it is generally difficult to establish. Most of these soils can be tilled throughout a relatively wide range of moisture conditions, but special precautions should be taken with Taft silt loam to prevent puddling and clodding.

GROUP 3

The two soils of group 3 differ from those of group 1 principally in that their texture is heavier and correspondingly more difficult to maintain in good physical condition. Both have restricted internal drainage, both are relatively high in plant nutrients, and neither is subject to appreciable accelerated erosion. They are fair to good soils for the common field crops, but are not so well suited physically to these crops as the soils of group 1.

These soils are better suited to corn and hay than to most other crops commonly grown in the area, and are relatively poorly suited to vegetable crops and alfalfa. The rotations suggested for the soils of group 2 are satisfactory for these soils also. Soybeans are sometimes seeded in corn to supply organic matter and to improve the physical condition of the soils. Lime generally need not be applied for the common crops. Most crops respond moderately to applications of phosphorus, and potash may be limiting in some areas.

These soils are well suited to permanent pasture, and good pasture management should be similar to that described for the soils of group 1.

No special practices are necessary for the control of runoff, but the soils should not be plowed in fall unless given a winter cover crop to prevent scouring during floods. To prevent destruction of good tilth the soils should not be tilled when too wet or too dry. More care should be exercised on these soils than on those of group 1 to maintain a high content of organic matter.

GROUP 4

The soils of group 4 are poorly drained soils of the first bottoms or colluvial lands. The content of plant nutrients and organic matter is relatively high, the reaction is neutral to medium acid, and the soils are not subject to appreciable accelerated erosion in most places. They receive depositions of fresh alluvium periodically, and their outstanding deficiency is drainage.

When undrained, these soils are poorly suited to most crops that require tillage, but they are fair to good for corn and hay if artificially drained. A good rotation on the drained soils is corn 1 year and red clover or alsike clover and grass 2 years. A cutting of hay

can be obtained the first year if the soil is well managed. Corn can be grown on the drained soils in successive years without appreciably reducing productivity. Alfalfa, small grains, and most vegetables are poorly suited to these soils.

Liming is generally not necessary for the crops to which the soils are well suited. Moderate applications of phosphorus under hay crops in the rotation generally produce good results both on hay and on corn that follows hay if the soils are drained. Potash may be limiting in some areas, but nitrogen can generally be maintained by the use of legumes in the rotation if the soil is drained. If the soil is not drained crop failures are to be expected frequently, owing to excessive moisture.

The soils are well suited to permanent pastures, and good pasture management is obtained largely through drainage, moderate applications of phosphorus every 3 or 4 years, moderately close grazing, scattering of droppings, and mowing of excess herbage. Water-tolerant plants dominate pastures not drained at the expense of more desirable legumes and grasses. Undergrazing favors the growth of undesirable pasture plants at the expense of such plants as bluegrass and white clover, and is probably more harmful than very close grazing.

Drainage, though highly beneficial for most crops on these soils, is difficult to establish. The heavy textures of the Burgin and Dunning soils make tile drainage relatively ineffective, compared with open ditches. Diversion ditches to catch runoff from adjacent slopes are highly beneficial for the Burgin soils in many places.

Good tilth is difficult to maintain on these soils. If they are used for crops that require tillage, care should be exercised to work them in the proper condition, and the rotations and amendments should provide for maintenance of a high content of organic matter in the plowed layer. In general, these soils are better suited physically to permanent pasture than to crops, but under careful management, including drainage, will produce fair to good yields of corn and hay.

GROUP 5

The soils of group 5 differ from those of group 4 principally in having a lower content of plant nutrients. They are poorly drained soils of first bottoms, terraces, and depressions and have nearly level relief. They are relatively low in content of plant nutrients and organic matter and are medium to very strongly acid.

They are poorly suited to crops that require tillage and can be expected to produce only mediocre yields of most crops, even though artificially drained. If they are used for crops, corn and hay are probably the ones best suited to them. Sorghum and soybeans can also be grown on artificially drained soils. Crops should probably be fertilized rather heavily with lime, phosphorus, and potash; nitrogen should be maintained either by leguminous hay crops, such as alsike clover, or by commercial fertilizer.

Pastures are generally fair to poor, but reasonably good pastures can be obtained if the soils are drained and limed; fertilized heavily with phosphorus, and probably with potash on the Atkins soils; grazed rather closely and clipped; and if droppings are scattered.

Undrained pastures might be improved by the practices suggested, but water-tolerant plants would probably be a larger part of the herbage than on drained soils.

GROUP 6

The soils of group 6 consist of relatively fertile, undulating or sloping, medium-textured, uneroded to moderately eroded areas of uplands, terraces, and colluvial lands. On the surface layers good tilth is relatively easy to obtain and maintain. All are relatively fertile but less well supplied with plant nutrients than the soils of group 1, and all are medium to strongly acid. They are not subject to rapid loss of plant nutrients by leaching and are only moderately subject to accelerated erosion. Physical condition for normal retention and movement of water and for aeration is good. Wolftever silt loam has slightly impeded internal drainage; but all others of the group are well drained.

These soils are well suited to most of the crops commonly grown. They can be conserved in a rotation that includes a clean-cultivated crop once in 2 or 3 years if other management requirements are met. A rotation of corn 1 year, small grain seeded to a leguminous hay crop 1 year, and hay or pasture 1 or more years is thought to be well suited to these soils. Red clover or alfalfa may be used for hay with good results, the red clover in a short rotation, and alfalfa if hay is desired for 3 or 4 years. Other intertilled crops may be substituted for corn. The rotation may be shortened safely to grow an intertilled crop every other year if a winter-legume green-manure crop is grown in between.

Phosphorus is probably the nutrient that is most generally limiting, although nitrogen requires constant attention for maintenance. In the rotations suggested, the leguminous crops may be depended upon for maintenance of most of the nitrogen. It may be advisable to plow under a leguminous crop at some point in the rotation if need for nitrogen is apparent, and this practice is especially desirable on the eroded phases. Most of the fertilizer should probably be applied to the legume seeding, and applications of the equivalent of 1 ton an acre of ground limestone, 300 pounds of 20-percent superphosphate, and 25 pounds of potash under red clover, or of the equivalent of 2 tons of ground limestone, 500 pounds of 20-percent superphosphate, and 25 to 50 pounds of potash under alfalfa should be satisfactory in most places. The quantities of each to apply will vary with the past management of the soil. Potash may not be necessary in some areas, and if manure is used potash may be omitted from the fertilizer mixture. Boron may be limiting in some areas, and its deficiency is generally apparent in alfalfa. This can be corrected by a very light application of borax if the soil has not been overlimed. Vegetables do well on these soils and require heavy fertilization with phosphorus, potash, and nitrogen. Manure is highly beneficial for most crops and is especially beneficial on small eroded spots that develop in some fields. It can replace part of the potash and nitrogen of fertilizer mixtures.

The soils can be tilled throughout a relatively wide range of moisture content without destruction of good tilth. Tillage should be on the contour where feasible, and the soils should not be bare of vege-

tation for extended periods. Terraces and other engineering methods of control of runoff are generally not necessary if other management requirements are met.

These soils produce good pastures, but they generally require lime and phosphorus for good results. Heavy applications at long intervals are more desirable than light applications at short intervals. It is especially important that the initial applications be heavy if the soil has not been limed or fertilized for a long time. These are intended to promote the growth of legumes that can be depended upon to fix nitrogen. To this same end, relatively close grazing favors legumes at the expense of grass, and the clipping of uneaten herbage periodically has a similar effect. Droppings should be scattered to provide uniform distribution of the potash and nitrogen they contain and to prevent cattle from leaving the herbage uneaten around them.

GROUP 7

The soils of group 7 have steeper slopes than those of group 6, the gradients ranging generally between 5 and 12 percent. They are moderately eroded, but relatively fertile, and have good moisture relations. Good tilth is comparatively easy to obtain and to maintain, but maintenance requires slightly more attention than on soils of group 6. These soils are subject to moderately rapid runoff, and practices for its control constitute the principal differences in management requirements between this group and group 6.

Rotations similar to those suggested for group 6 but including at least 2 years of a leguminous sod-forming crop are considered well suited to these soils if other management requirements are met. A 4- or 5-year rotation of corn, small grain, clover and grass, and grass and clover for hay or rotated pasture is suitable; and the longer rotation suggested for the soils of group 6 of corn, small grain, and alfalfa for 2 to 4 years is also satisfactory. Other intertilled crops may be used for corn in these rotations.

The fertilizing and liming practices suggested for group 6 are also suitable for these soils. Generally the soils are slightly more eroded than those in group 6, and application of manure to eroded spots is beneficial.

It is highly important that tillage be on the contour and that the soils be not long bare of vegetation; they should not be plowed in fall and allowed to lie bare over winter. Runoff can generally be controlled without resorting to terracing, but terracing should be considered on the longer slopes if intertilled crops are to be grown frequently in the rotation. Strip cropping may be feasible and desirable in many places on long and relatively uniform slopes.

The practices of good management of permanent pastures are essentially similar to those for the soils of group 6.

GROUP 8

The soils of group 8 have steeper slopes and generally are more severely eroded than those of group 6, and they are either more severely eroded or have steeper slopes than those of group 7. The problem of control of runoff and consequent problems of conservation of water and of soil materials are greater than for those of group 7. Subsoil material is incorporated with the plow layer in most places; the supply of

available plant nutrients, especially nitrogen, is lower, and the maintenance of good tilth and an adequate supply of moisture are more difficult than on the soils of group 6. All these soils except Dewey silty clay loam, eroded hilly phase, which has a gradient of 12 to 30 percent, have slopes that range between 5 and 12 percent.

Clean-cultivated crops should be grown on these soils as little of the time as feasible in a system of good farm management. Close-growing crops, as small grain and hay, should occupy the soil most of the time. A 5- or 6-year rotation of corn, small grain, and alfalfa can be used successfully if other management requirements are met. Another suggested rotation is corn; small grain; clover, orchard grass, and timothy 2 years; small grain; and clover, orchard grass, and timothy 2 years. Corn can be omitted from this last rotation to good advantage. If the soils have been restored to a productive condition by continued good management that has built up the contents of organic matter of the surface layer and improved the ability of the soil to absorb water, rotations suggested for the soils of group 7 can be used safely on all except the eroded hilly Dewey, provided other management requirements are met.

These soils are generally lower in content of organic matter and in most plant nutrients than group 6. Restoration of the severely eroded phases to a productive condition can well be inaugurated by the growth of a green-manure crop the first year to be plowed under before the rotations suggested above are begun. Fertilization of the rotation generally should include some means of supplying nitrogen until a leguminous crop can be established. Manure is especially beneficial for most crops on these soils, and particularly good results have been obtained from its use preparatory to the seeding of alfalfa or other legumes. Such crops are commonly difficult to establish the first time. The legumes in the rotation should probably receive heavy applications of lime, phosphorus, and potassium until the fertility of the soils has been restored to some extent, after which fertilization similar to or slightly heavier than that described for the soils of group 6 may be used.

The soil cannot be tilled successfully throughout as wide a range of moisture content as in group 6 or 7. Tillage should be on the contour, and strip cropping may be used to good advantage on the longer slopes. Hillside ditches and terraces may prove beneficial on some of the longer slopes of the severely eroded soils, but they can generally be avoided if other management requirements are met. The advisability of their construction on the eroded hilly Dewey soil is questionable.

In many places, these soils can be used to best advantage for pasture, but heavy applications of lime, phosphorus, and in some places potash are usually necessary. Once pastures are established, management similar to that described for group 6 will be satisfactory in most places.

GROUP 9

The greatest difference between soils of group 9 and those of group 6 is that the former are of intermediate instead of high fertility. They are undulating or gently sloping light- or medium-textured soils of the uplands, terraces, and colluvial lands. They also differ in having good physical condition for the maintenance of good tilth and for

good absorption of water, in being well drained, but not excessively, and in being generally less susceptible to accelerated erosion than are the soils of group 6, which have similar slopes. The problem of water control is concerned more with conservation of water than with control of erosion. The soils are lower in organic matter and in most plant nutrients than in group 6, nitrogen and potash are more commonly limiting, and the more soluble fertilizer materials may be lost somewhat more rapidly by leaching. These are moderately productive soils for most of the crops commonly grown, and most of these respond well to good management.

So far as consistent with operating limitations of the individual farms, the choice and rotation of crops should be planned to increase fertility. The rotation should include the production of leguminous crops frequently and the return to the soil directly or indirectly as manure of as much of the vegetation as is consistent with good farm management. A 2-year rotation of corn and small grain and lespedeza should be satisfactory. A longer rotation that consists of corn, small grain, and red clover and grasses would also be satisfactory, but it would require considerably heavier fertilization and liming for the red clover than for the lespedeza. Vegetables are well suited to most of these soils and can be substituted for corn in the rotations suggested. Two or more vegetable crops may be grown in successive years with a green manure crop between them, but it is generally advisable to substitute hay periodically.

Moderate applications of phosphorus and potash should probably be made at relatively short intervals. It may be advisable to fertilize the small grain and lespedeza or small grain and clover crop with moderate to light applications of potash and supply some potash to the corn crop, and to apply phosphorus and lime just before the leguminous crop. Application of the equivalent of 300 pounds an acre of 20-percent superphosphate and 1½ to 3 tons of ground limestone just before the legume in a 3- or 4-year rotation will probably satisfy the requirements of most crops in the rotation for those amendments. Probably the equivalent of 100 pounds of muriate of potash divided between the hay and corn crop is adequate, and less than that quantity may be sufficient in many places. The quantities necessary will vary with the past management of the soil. In this group it appears more desirable to make light applications of the more soluble fertilizer materials at frequent intervals than to make heavy applications at long intervals.

These soils may be tilled over a wide range of moisture conditions. Special tillage practices are generally not necessary for the control of runoff, but it is advisable to cultivate on the contour where feasible and not to leave the soil bare over winter. Terracing and strip cropping are generally not necessary.

Pastures are generally poor unless well managed. Moderate quantities of lime should be applied at relatively short intervals after an initial heavy application, and phosphorus should be supplied in relatively large quantities. An application of potash may aid in the establishment of a good pasture, after which sufficient potash may be derived from the droppings, but these should be scattered. Very close grazing is more harmful than on pastures in group 6, but undergrazing is equally harmful, and uneaten herbage should be clipped.

GROUP 10

The soils of group 10 differ from those of group 9 principally in having sloping or rolling instead of gently sloping or undulating relief. Most of them are also moderately, but not severely, eroded. They are moderately fertile well-drained medium- to light-textured soils of the sloping or rolling uplands, terraces, or colluvial lands. Slopes range from 5 to 12 percent. They are moderately fertile, though nitrogen, phosphorous, or potash may be limiting for good plant growth. The soils present a moderate but not serious problem in runoff control. Susceptibility to erosion is generally less than on similar slopes developed from limestone materials, but is sufficient to warrant management practices that will not only be concerned as much as is feasible with maintenance or increase of the contents of nitrogen, phosphorus, potash, and organic matter, but also will regulate the rate of runoff.

The choice and rotation of crops should provide a legume crop at moderately short intervals; time between intertilled crops should be slightly longer than the minimum considered good for group 9. A rotation of corn, small grain, and lespedeza and grass for 2 years should be satisfactory. Alfalfa or red clover may be used instead of lespedeza and grass, but they require heavier fertilization and liming. Vegetable crops may be grown in place of corn in such rotation. In general, 2 or 3 years of a leguminous sod-forming crop should be allowed in the rotation. This period may be shortened safely by the use of a winter-legume green-manure crop to be plowed under before the intertilled crop.

Fertilization of the rotations suggested should be similar to that described for the soils of group 9, but if the rotation is longer, slightly heavier applications of lime and phosphorus under the leguminous crop or light applications under another crop in the rotation may be advisable. The vegetables grown generally respond well to heavy applications of nitrogen, phosphorus, and potash, and these heavy applications, supplemented by lime and probably by additional phosphorus for the legume, will generally have sufficient residual effect for other crops in a 4- or 5-year rotation. Alfalfa requires heavy applications of lime, phosphorus, and probably potash. Manure generally produces very favorable results with most of the crops commonly grown.

Tillage should be on the contour as much as is feasible in good farm management. Although terracing is generally not necessary for the control of runoff if the requirements of a good rotation, good fertilization, and proper tillage are met, it may be effective on the longer slopes of some of these soils in the control of runoff where intertilled crops are grown frequently in the rotation. Strip cropping may be desirable in some places. Tillage can be performed throughout a relatively wide range of moisture content. The soil should not be allowed to lie bare for extended periods, and winter legumes should be grown in the rotation when otherwise the soil would be bare over winter. This crop can be turned under in spring as a green manure to serve not only as a cover to control runoff but also as a means of maintaining the content of nitrogen and organic matter.

Good pasture management should be similar to that suggested for group 9. The additional problem of control of runoff will be largely

solved if practices that aid in establishing and maintaining a good pasture are followed. Contour furrowing may aid in the conservation of water for plant growth.

GROUP 11

Group 11 consists of hilly and moderately to severely eroded medium fertile soils of the uplands and terraces. Slopes range between 12 and 30 percent on all except Apison very fine sandy loam, eroded rolling phase, and Fullerton cherty silt loam, severely eroded phase. All are subject to rapid runoff and all are susceptible to serious erosion.

These soils are poorly suited to crops that require tillage, but where those crops are necessary they should be in a rotation that includes long periods of close-growing and sod-forming crops. Intertilled crops should be grown as little of the time as feasible. Where they are to be grown, it is probable that a rotation that includes small grain, clover and grass hay, and pasture for 2 or 3 years would be suitable. If it is not necessary to grow an intertilled crop, small grain can be used as a nurse crop as often as necessary to reestablish a hay or pasture seeding. Limited experience indicates that a contour furrow seeder recently introduced in this area can be used to good advantage to seed small grain in hay or pasture sods without plowing. Lespedeza or other legumes and grasses may be broadcast in spring in the small grain to reestablish the hay or pasture. Farmers have recently had good success on the Apison soil with a 6-year rotation of corn, small grain, and alfalfa, using heavy applications of lime and phosphorus.

Any of the rotations suggested above should be limed heavily and fertilized heavily with phosphorus. Both probably should be applied under the leguminous hay crop. Light to moderate applications of potash may be beneficial for some crops in the rotation. If alfalfa is grown, it should be limed and fertilized with phosphorus more heavily than is necessary for good production of red clover and grass. Manure is highly beneficial on severely eroded spots and is generally beneficial on all of these soils for most crops.

Tillage should be on the contour, and strip cropping is desirable where feasible, but terracing is not feasible on such steep slopes. The soils can be tilled throughout a relatively wide range of moisture conditions without destruction of good tilth except on the severely eroded hilly phases of Dewey silty clay loam and Fullerton cherty silt loam. These soils should be bare of vegetation as little of the time as feasible, and winter-legume cover crops should be grown whenever the soil would be otherwise left bare over winter.

These soils are better suited physically to permanent pasture than to crops that require tillage. Permanent pastures should receive moderate applications of lime at relatively short intervals after an initial heavy application. They should also receive relatively large applications of phosphorus. Application of potash may aid in obtaining a good stand of desirable pasture plants, particularly on the severely eroded soils, but after establishment of a good pasture sod, scattering of droppings will probably provide sufficient potash for good production. More care should be given these pastures to prevent formation of incipient gullies or galled spots than in group 10, and on severely eroded areas application of manure aids greatly in reestablishing a good sod.

GROUP 12

The soils of group 12 are among the least fertile of the county. They differ from those of group 9 mainly in having lower contents of organic matter available nitrogen, phosphorus, and potash. Pope loamy fine sand is probably the lowest in these constituents. The soils are well drained, strongly to very strongly acid, and undulating or very gently sloping, and are derived mainly from sandstone or highly siliceous limestone materials. They are open and porous, have a relatively low water-holding capacity, and are subject to rather rapid loss by leaching of soluble plant materials, in which they are low. They are not subject to rapid runoff and are not susceptible to serious erosion. Their physical properties are favorable for the maintenance of good tilth.

Management practices should be designed primarily for the maintenance of organic matter and plant nutrients. To this end, the choice and rotation of crops should provide leguminous crops at frequent intervals, and as much of the vegetation as is consistent with good farm management should be returned to the soil either directly or indirectly as manure. Green manure crops are especially beneficial. Some of the leguminous crops that can be used are lespedeza, red clover, crimson clover, and hairy vetch. To grow alfalfa would require very heavy applications of lime, phosphorus, and potash.

Rotations similar to those suggested for group 9 should be satisfactory for these soils. Corn followed by small grain and lespedeza is a common rotation that appears to be well suited to the soils. A rotation of corn, small grain, and red clover can also be used. Vegetables and other intertilled crops can be substituted for corn in these rotations, or intertilled crops can be grown in successive years with a green-manure crop planted after one crop and plowed under before the next.

The rotations suggested require heavy fertilization for good results, the lime and phosphorus under the legumes and the potash and, in some cases, nitrogen under the intertilled crop. Vegetables should be fertilized heavily with a complete fertilizer, and legumes that follow them can generally depend on the residual effects of such fertilizers, except lime. Especially beneficial for most crops is manure, which not only supplies organic matter and nitrogen but also potash, which is commonly limiting.

These soils may be tilled throughout a wide range of moisture content without destruction of good tilth. Few special tillage practices are required to control the runoff, and terracing and strip cropping are generally not necessary.

Pastures are poor on these soils unless fertilized heavily. They should generally receive heavy initial applications of lime and phosphorus, and in some places potash, to be followed by moderate applications of the same nutrients at relatively short intervals. Extremely close grazing should be avoided, but undergrazing is also harmful. Droppings should be scattered and uneaten herbage should be mowed periodically.

GROUP 13

The soils of group 13 differ from those of group 12 mainly in having steeper slopes, the gradients ranging between 5 and 12 percent. The

content of nitrogen, phosphorus, potash, and organic matter is low. The soils are open and porous, only moderately susceptible to accelerated erosion, and generally absorb water well, but runoff is relatively rapid and should be controlled to allow maximum absorption. Soluble plant nutrients are lost relatively rapidly by leaching. The moisture-holding capacity is relatively low, and the soils are inclined to be droughty.

Rotations are suggested that include a leguminous hay or pasture crop for 1 or 2 years longer than recommended for group 12. A rotation of corn, small grain, and lespédeza and grass for 2 or 3 years should be satisfactory. Other intertilled crops may be substituted for corn, and clover can be used in place of lespedeza if it is fertilized heavily. Green manures used in the rotation are highly desirable to aid in the maintenance of organic matter and nitrogen.

Fertilization and liming practices suggested for group 12 should be satisfactory for these soils also. Heavy applications of lime, phosphorus, and probably potash should probably be made under the leguminous crop. For good yields, vegetables generally require heavy applications of complete fertilizers, and the residual effects can generally be depended upon for crops to follow. Manure is especially beneficial in the maintenance of organic matter, nitrogen, and potash.

Tillage should be on the contour. Terracing and strip cropping are generally not necessary if the soil is properly managed with respect to choice and rotation of crops, fertilization, tillage, and other practices. They may be desirable to aid in the control of runoff where intertilled crops are to occupy the land much of the time.

Good pasture management should involve the practices suggested for group 12. Pastures are generally poor, but can be made fair to good if moderate to large quantities of lime and phosphorus, and, in some places, potash are applied at relatively short intervals, provided grazing is well managed and other requirements of good pasture management are met. Heavy initial applications of lime and phosphorus and moderate applications of potash are generally needed for the establishment of good pastures on old poor pasture land.

GROUP 14

The soils of group 14 are hilly and relatively low in content of plant nutrients and water-holding capacity. They have steeper slopes than soils in group 13 and differ also in management requirements that concern control of runoff.

These soils are poorly suited to crops that require tillage, but if used for them, close-growing or sod-forming crops should be on the soil as much of the time as feasible. In these respects the requirements are similar to those of group 11, but the requirements for maintenance of plant nutrients are generally higher. Intertilled crops should be grown as little of the time as feasible, and if grown, about 4 to 6 years of close-growing and sod-forming crops should intersperse them. A rotation consisting of small grain, hay, and pasture is probably better suited to these soils than a rotation that includes an intertilled crop. As suggested for soils of group 11, small grains may be seeded in a lespedeza sod by means of a contour furrow seeder without plowing. Lespedeza can be broadcast in the small grain in spring to be harvested the following fall.

Fertilization should be heavy for good crop yields as in group 13. Lime and phosphorus need to be applied almost everywhere for good production of leguminous crops, and potash may be expected to be limiting unless manure or potash-carrying fertilizer is used. It may be necessary to apply nitrogen for corn unless a green manure or barnyard manure has been used. Tillage should be on the contour at all times, and strip cropping is beneficial in controlling runoff. Terracing is not considered feasible.

Pastures are generally only fair on these soils, although they are better suited physically to permanent pasture than to crops that require tillage. Heavy fertilization with phosphorus and application of large quantities of lime and possibly of potash are necessary for the establishment of good pastures. After pastures are established it is thought that moderate applications of lime at short intervals are to be preferred to heavy applications at long intervals.

GROUP 15

The two units of group 15 are relatively shallow undulating soils over acid shale, with a gradient of 2 to 7 percent. They are strongly acid, low in available calcium and phosphorus, and more susceptible to accelerated erosion than most other soils of similar slopes. Though generally deficient in nitrogen and organic matter, it is probable that they contain more potash in their substrata than soils derived from sandstone. The increase and maintenance of organic matter and plant nutrients and the control of runoff are of primary importance.

One of the most effective means of controlling runoff appears to be the use of close-growing and sod-forming crops a considerable part of the time. Leguminous hay crops would help maintain the organic matter and nitrogen of the soil also. A few farmers have had excellent results with a rotation of corn, small grain, and alfalfa for 3 years, fertilized heavily with phosphorus and given heavy applications of lime. The alfalfa apparently is able to reach and use the potash of the shale substrata. It is probable that a shorter rotation properly managed could be used without serious loss of soil material. An intertilled crop could be used, followed by a small grain for 1 year and a leguminous hay crop, such as red clover and grass, for 1 or 2 years. For good yields, such a rotation should be fertilized with large quantities of phosphorus and heavy applications of lime.

The soil should not be bare of vegetation for extended periods, and winter-legume cover crops that are turned under in spring as green manure can be used to control winter runoff and help maintain organic matter and nitrogen. Tillage should approximate the contour where feasible on the steeper slopes. Terracing might not be a good practice on these shallow soils, and strip cropping is generally not necessary if other management requirements are met, though it may be practiced with considerable benefit in some places.

Pastures are generally poor, but can be made fair to good by good management, including application of lime and phosphorus. Fertilization and liming should be relatively heavy.

GROUP 16

Group 16 is made up of shallow to moderately shallow heavy-textured moderately fertile soils of mild slopes, difficult to till and to maintain in good tilth. Water penetrates these soils slowly, and water movement in them is slow. The soils are generally deficient in nitrogen, organic matter, and phosphorus but are not so deficient in lime and potash as are most others. Two of the main management problems are maintenance of good tilth and improvement of physical condition for absorption and maintenance of an adequate supply of water for plant growth.

These soils are limited in their suitability for crops, and are poorly suited to vegetables, though hay and pasture plants produce fairly well. Upshur silt loam and Colbert silt loam, deep phase, have the widest range of suitability for crops of this group.

It is desirable to grow deep-rooted leguminous crops and to use green manures on these soils to improve their physical condition and help maintain their content of organic matter and nitrogen. Alfalfa, sweetclover, and sericea lespedeza are suggested as deep-rooted legumes, and crimson clover or vetch and small grain for green manures. A rotation of corn, small grain, and alfalfa is thought to be suitable, and a row crop can be grown safely once in 3 years. Red clover can be used in place of alfalfa if a shorter period of hay is desired.

Phosphorus is the principal limiting nutrient, and large applications should be made at relatively long intervals under the legume in the rotation. In most places 1½ tons of ground limestone once in the rotations suggested is sufficient. Colbert silt loam, deep phase, may require slightly heavier applications of lime than other soils of this group. Manure is generally beneficial for most crops and may aid greatly the establishment of hay seedings on Colbert silty clay loam, eroded phase.

Tillage should be performed within a relatively narrow range of moisture content to avoid destruction of good tilth and should be on the contour if feasible. Terracing and strip cropping are generally not desirable practices. Fall plowing will improve tilth if cover can be provided to prevent excessive runoff and consequent erosion.

Pastures on these soils are generally fair, but for good yields should receive heavy applications of phosphorus at relatively long intervals. Liming is probably more important on Colbert silt loam, deep phase, than on other soils of this group, but the requirement for lime varies considerably from place to place on all of them. If other management requirements are met and pastures do not respond, application of about 1 to 1½ tons of ground limestone every 5 years may remove the limiting factor. Pastures on these soils are harmed more by undergrazing than by overgrazing, and excess herbage should be clipped, and droppings should be scattered.

GROUP 17

These soils of group 17 are heavy-textured and moderately fertile, with rolling relief, the slopes ranging from 5 to 12 percent. All are shallow, and one, rolling stony land (Colbert soil material), is so

shallow and has so many rock outcrops that it generally cannot be tilled with ordinary implements. Others of this group differ from group 16 mainly in having steeper slopes.

If these soils are used for crops that require tillage, intertilled crops should be used as little of the time as feasible. In general, the soils can be maintained in productive condition, and runoff can be controlled in a rotation that includes an intertilled crop once in 4 to 6 years. Rotations such as those suggested for group 16 can be used by allowing the hay or pasture crop to remain on the soil 2 or 3 years longer. Alfalfa is admirably suited to this rotation.

Fertilization of the suggested rotations should be similar to that recommended for the rotations of group 16, but potash and nitrogen may be limiting in more cases. Applications of manure before seeding the legume is highly beneficial in establishing the seeding on these moderately eroded soils. These applications not only supply nitrogen and potash but also aid in the maintenance of good physical condition.

It is highly desirable that cultivation be on the contour and that these soils be bare of vegetation very little of the time; if tilled in fall, cover crops should be grown to protect the soils in winter and to supply organic matter when turned in spring. Tillage should be done within a relatively narrow range of moisture content to avoid destruction of good tilth. Terracing generally is not a good practice on these heavy-textured shallow soils, but strip cropping may be desirable on the longer slopes.

Good pasture management involves about the same practices as suggested for group 16. It should include heavy application of phosphorus and moderate to light applications of lime at long intervals, clipping of ungrazed herbage, scattering of droppings, and carefully controlled grazing. Both undergrazing and overgrazing should be avoided.

MISCELLANEOUS GROUP

The Fifth-class soils of Rhea County constitute a miscellaneous group poorly suited physically both to crops that require tillage and to permanent pasture. (The table of productivity ratings, p. 160, lists these soils.) One soil, Apison very fine sandy loam, severely eroded rolling phase, has been used successfully for crops by a few farmers in a long rotation of corn, small grain, and alfalfa that was heavily limed and phosphated. The rest of the soils of this group have such poor moisture relations or such poor fertility, or both, that it has generally not been feasible to apply the intensity of management practices necessary to obtain even fair yields of crops or of pasture.

ADDITIONAL MANAGEMENT INFORMATION

The Tennessee Agricultural Experiment Station and the College of Agriculture have accumulated much information relative to management requirements of various crops, fertilizers, and fertilizer practices, and the suitability of various crops and varieties of crops to Tennessee conditions. Some of that information relates to specific soil types, but a considerable part is of a more general nature. The scope of this report does not include the details of results of the

numerous experimental projects; therefore, the reader is referred to the following publications for more specific information on subjects indicated by the titles:

Tennesee Agricultural Experiment Station Circulars:
- 6, The Value of Farmyard Manures
- 9, Nitrogenous Fertilizer Materials
- 10, A Select List of Varieties of Farm Crops.
- 11, Rates and Dates of Planting for Tennessee Farm and Garden Crops.
- 12, Alfalfa and Sweet Clover Culture
- 14, Austrian Winter Peas
- 27, A Select List of Varieties of Vegetables.
- 30, Three New Varieties of Lespedeza.
- 34, Increasing the Profits from Phosphates for Tennessee Soils.
- 45, Balbo Rye.
- 49, Korean Lespedeza.
- 52, Rye for Pasture and Seed in Tennessee.
- 60, Fertilizers for Tennessee Soils.

Tennesee Agricultural Experiment Station Bulletins:
- 126, Varieties of Corn and Their Adaptability to Different Soils
- 136, The Oat Crop.
- 141, The Comparative Values of Different Phosphates.
- 142, The Effect of Various Legumes on the Yield of Corn.
- 149, Fertilizers and Manure for Corn.
- 154, Lespedeza Sericea.
- 161, Burley Tobacco Culture.
- 165, Clovers and Grasses for Hay and Pasture.
- 169, Types of Farming in Tennessee

Tennessee College of Agriculture Extension Publications:
- 213, Alfalfa in the Tennessee Farm Program.
- 217, A Pasture Program for Tennessee Farms

Tennessee Department of Agriculture Horticulture and Apiaries Division Circular:
- 3, How to Grow Strawberries in Tennessee.

PRODUCTIVITY RATINGS

The yields that may be expected from various crops are shown in table 7 for each soil in Rhea County. Three yields are given for most of the crops on each soil, corresponding to estimated yields under each of three levels of management (columns A, B, and C under each crop listed). Yields may be expected to vary widely on most soils, according to the way the soil and crop are managed. Management itself differs greatly among the farms.

In columns A are estimated yields without special practices to increase productivity. No manure or commercial fertilizer and no lime or other amendment are used, and no special effort is made in the selection and rotation of crops to return organic matter and nitrogen to the soil. Most of the yields in this column are those that would be expected from land that had been cleared of forest for 5 years or more.

In columns B are estimated yields under the present dominant level of soil management. The practices followed on any one of the soils of the county are as varied as the farms on which the soil exists, and the degree of that variation is not the same for all soils. Strict definition of the current management of any soil or group of soils resolves into definition of management of that soil for a great many individual farms or for fields within those farms. It is usually possible, however, to give a general description of one or two major types of management commonly practiced on a soil or group of soils, to represent the approximate level of management of the various soils of the county. A similar level of management is obtained on many farms by different combinations of management practices.

TABLE 7.—*Estimated yields per acre of the principal crops under each of three levels of management, a... soil of Rhea County, Tenn.*

Soil	Corn			Wheat			Oats			Lespedeza hay			Alfalfa hay			Straw...
	A [1]	B [2]	C [3]	A	B	C	A	B	C	A	B	C	A	B	C	A
	Bu	*Bu*	*Bu.*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	
Abernathy silt loam	45	45	50	13	14	15	20	23	25	1.4	1.4	1.7	2.8	3.0	3.6	(7)
Allen stony fine sandy loam, eroded phase	13	20	30	5	8	13	10	15	25	4	5	9	(8)	1.8	2.6	40
Allen very fine sandy loam	18	28	43	8	10	20	15	20	40	9	1.2	1.5	(8)	2.4	3.2	50
Eroded sloping phase	15	23	35	6	9	18	13	18	35	6	8	1.2	(8)	1.8	2.6	35
Apison very fine sandy loam	13	23	30	6	9	18	13	18	35	5	8	1.1	(8)	2.4	3.2	35
Eroded phase	5	13	28	5	8	15	10	15	30	.3	5	1.0	(8)	2.2	3.0	30
Eroded rolling phase	5	8	23	4	5	13	8	10	25	2	5	9	(8)	2.0	2.8	25
Severely eroded rolling phase	(8)	(8)	20	(8)	(8)	11	(8)	(8)	23	(8)	(8)	7	(8)	1.8	2.6	(8)
Atkins silt loam (undrained)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)	(7)	(8)	(8)	(8)	(8)
Atkins very fine sandy loam (undrained)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(7)	(7)	(7)	(8)	(8)	(8)	(8)
Burgin clay loam (undrained)	13	13	[9]40	(8)	(8)	(7 9)	(8)	(8)	(7 9)	7	8	[9]1.4	(8)	(8)	(8)	(8)
Clarksville cherty silt loam	10	15	25	5	8	15	10	15	30	4	5	1.1	(8)	1.4	2.0	35
Eroded phase	8	13	20	4	6	11	8	13	23	3	5	1.0	(8)	1.2	1.8	30
Eroded hilly phase	5	10	18	4	5	9	8	10	18	2	4	9	(8)	1.0	1.6	25
Eroded steep phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Hilly phase	8	13	20	4	6	10	8	13	20	3	5	1.0	(8)	1.2	1.8	30
Undulating phase	13	18	28	5	9	17	10	18	35	5	6	1.2	(8)	1.4	2.0	40
Colbert silt loam	10	15	25	8	10	15	15	20	30	5	8	1.1	4	2.0	2.8	(7)
Deep phase	18	25	35	10	14	20	20	28	40	8	1.1	1.4	6	2.6	3.4	(7)
Colbert silty clay loam																
Eroded phase	8	13	20	5	8	10	10	15	20	3	5	1.0	(8)	1.8	2.6	(7)
Eroded rolling phase	5	10	15	4	6	9	8	13	18	3	5	9	(8)	1.6	2.0	(7)
Conasauga silt loam	10	15	25	8	10	15	15	20	30	.5	8	1.2	4	2.0	2.8	(7)
Conasauga silty clay loam																
Eroded phase	8	13	20	5	8	10	10	15	20	3	5	1.1	(8)	1.6	2.0	(7)
Severely eroded phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Crossville loam	15	25	35	5	9	17	10	18	35	5	8	1.1	(8)	1.4	2.0	50
Rolling phase	13	20	30	5	8	15	10	15	30	.4	7	1.0	(8)	1.3	1.9	45
Cumberland gravelly fine sandy loam	18	28	40	8	15	20	15	30	40	6	9	1.2	(8)	2.4	3.2	50
Eroded hill phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	4	5	1.0	(8)	1.2	1.6	(8)
Eroded sloping phase	15	20	25	5	9	15	10	18	30	5	8	1.2	(8)	2.0	2.8	35

See footnotes at end of table.

TABLE 7.—*Estimated yields per acre of the principal crops under each of three levels of management, a*
soil of Rhea County, Tenn.—Continued

Soil	Corn			Wheat			Oats			Lespedeza hay			Alfalfa hay			Straw
	A [1]	B [2]	C [3]	A	B	C	A	B	C	A	B	C	A	B	C	A
Cumberland silty clay loam	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	
Eroded phase	20	30	45	8	15	20	15	30	40	.9	1.2	1.4	(9)	3.0	3.8	(7)
Eroded sloping phase	18	28	40	6	14	18	13	28	35	.8	1.1	1.3	(9)	2.8	3.6	(7)
Severely eroded sloping phase	(9)	(9)	25	(9)	(9)	13	(9)	(9)	25	(9)	(9)	.8	(9)	(9)	2.0	(9)
Dewey silt loam	25	38	50	10	20	26	20	40	50	1.0	1.2	1.5	.8	3.2	4.0	(7)
Dewey silty clay loam:																
Eroded hilly phase	13	20	30	5	9	14	10	18	28	.5	.7	1.2	(9)	2.5	3.0	(7)
Eroded phase	18	28	40	6	14	18	13	28	35	.8	1.1	1.3	(9)	2.8	3.6	(7)
Eroded undulating phase	20	30	45	8	15	20	15	30	40	.9	1.1	1.4	(9)	3.0	3.8	(7)
Severely eroded hilly phase	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	.7	(9)	(9)	1.6	(9)
Dunning silty clay loam (undrained)	10	10	[9] 38	(9)	(9)	(9)	(9)	(9)	(9)	.6	.7	[9] 1.3	(9)	(9)	(9)	(9)
Egam silty clay loam	35	40	45	10	13	13	18	20	28	1.2	1.3	1.4	(9)	(9)	(9)	(7)
Emory silt loam	35	40	50	10	20	26	20	40	50	1.3	1.3	1.6	2.8	3.0	3.5	(7)
Sloping phase	33	35	48	8	15	20	15	30	40	1.1	1.2	1.5	2.6	2.8	3.4	(7)
Etowah silt loam	25	38	50	10	20	26	20	40	50	1.0	1.2	1.5	.8	3.2	4.0	(7)
Etowah silty clay loam:																
Eroded phase	20	30	45	8	15	20	15	30	40	.9	1.2	1.4	(9)	3.0	3.8	(7)
Eroded sloping phase	18	28	40	6	14	18	13	28	35	.8	1.1	1.3	(9)	2.8	3.6	(7)
Fullerton cherty silt loam	13	18	30	6	9	16	13	18	33	.5	.8	1.1	(9)	2.0	2.8	40
Eroded phase	10	18	30	5	8	12	10	15	23	.4	.6	1.0	(9)	1.8	2.6	35
Eroded hilly phase	8	10	20	5	6	10	10	13	20	.3	.5	.9	(9)	1.6	2.4	30
Eroded steep phase	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)
Hilly phase	10	15	23	5	8	11	10	15	23	.4	.6	1.0	(9)	1.8	2.6	35
Severely eroded phase	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	.7	(9)	(9)	1.6	(9)
Severely eroded hilly phase	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	.6	(9)	(9)	(9)	(9)
Undulating phase	15	23	33	6	10	17	15	20	33	.5	.8	1.1	(9)	2.0	2.8	45
Fullerton silt loam	18	25	35	8	11	18	15	20	35	.6	.9	1.2	(9)	2.2	3.0	50
Greendale cherty silt loam	15	25	38	6	11	20	13	23	40	.5	.9	1.2	(9)	2.2	3.0	45
Greendale silt loam	20	35	45	9	15	23	18	30	45	.7	1.0	1.4	(9)	2.4	3.2	55
Guthrie silt loam	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	.4	.4	[9] .7	(9)	(9)	(9)	(9)
Hanceville fine sandy loam	15	25	35	5	8	15	10	15	30	.4	.7	1.0	(9)	1.3	1.9	40
Hartsells fine sandy loam	15	25	35	5	9	17	10	18	35	.5	.8	1.1	(9)	1.4	2.0	50
Eroded rolling phase	10	18	25	4	6	11	8	13	23	.3	.6	.9	(9)	1.2	1.8	35
Rolling phase	13	20	30	5	8	15	10	15	30	.4	.7	1.0	(9)	1.3	1.9	45

Hector fine sandy loam, eroded phase	(5)	(8)	(8)	(5)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Hector *stony* fine sandy loam	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Holston gravelly fine sandy loam	10	15	20	4	8	15	8	15	30	.3	4	8	(8)	1.2	1.8	35
Holston very fine sandy loam	15	25	35	6	10	17	13	20	35	5	.8	1.1	(8)	1.4	2.0	(7)
Huntington fine sandy loam	40	40	45	11	13	14	18	20	25	1.3	1.3	1.5	2.4	2.6	3.0	(7)
Huntington silt loam	50	50	55	13	14	15	20	25	28	1.4	1.4	1.7	2.6	2.8	3.2	(7)
Jefferson *stony* fine sandy loam	10	18	30	5	8	15	10	15	30	.4	7	1.0	(8)	1.3	1.9	35
Eroded sloping phase	5	10	18	3	5	10	5	10	20	3	.6	.9	(8)	1.1	1.7	25
Jefferson very fine sandy loam	15	25	35	5	9	17	10	18	35	.5	.8	1.1	(8)	1.4	2.0	40
Eroded sloping phase	10	18	25	4	6	11	8	13	23	.3	.6	9	(8)	1.2	1.8	30
Limestone outcrop	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Lindside silt loam	35	40	[9] 50	9	10	[9] 13	18	20	[9] 28	1.3	1.3	1.6	(8)	(8)	(8)	(7)
Lindside silty clay loam	25	30	[9] 45	9	10	[9] 13	15	18	[9] 25	1.2	1.2	1.5	(8)	(8)	(8)	(7)
Melvin silt loam	(8)	(8)	[9] 40	(8)	(8)	[9] 11	(8)	(8)	[9] 20	5	6	[9] 1.3	(8)	(8)	(8)	(8)
Mines, pits, and dumps	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Montevallo silt loam, hilly phase	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Muskingum stony fine sandy loam	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Eroded hilly phase	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(5)	(8)	(5)	(8)	(8)	(8)	(8)
Hilly phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Rolling phase	5	10	15	3	5	10	5	10	20	3	5	7	(8)	(8)	(8)	25
Nolichucky fine sandy loam	15	25	35	5	9	17	10	18	35	5	.8	1.1	(8)	1.4	2.0	40
Eroded sloping phase	10	18	25	4	6	10	8	13	20	3	6	9	(8)	1.2	1.8	30
Ooltewah fine sandy loam	20	30	[9] 40	8	9	[9] 11	15	18	[9] 23	7	9	1.0	(8)	(8)	(8)	(7)
Ooltewah silt loam	35	40	[9] 50	9	10	[9] 13	18	20	[9] 25	1.3	1.3	1.6	(8)	(8)	(8)	(7)
Philo fine sandy loam	15	20	[9] 30	6	8	[9] 10	13	18	[9] 23	5	7	1.0	(8)	(8)	(8)	(7)
Philo silt loam	18	23	[9] 35	6	9	[9] 13	15	20	[9] 25	6	8	1.0	(8)	(8)	(8)	(7)
Pope fine sandy loam	20	30	40	*10*	*11*	*13*	*15*	20	25	6	9	1.0	(8)	(7)	(7)	(7)
Pope loamy fine sand	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(5)	(8)	(8)	(8)
Pope silt loam	25	35	45	11	13	14	18	23	28	.7	1.0	1.4	(8)	(7)	(7)	(7)
Roane gravelly silt loam	10	18	28	5	8	15	10	15	23	4	8	1.1	(8)	2.0	2.8	35
Roane silt loam	20	35	45	11	13	18	18	23	28	7	1.0	1.4	(8)	2.2	3.0	50
Robertsville silt loam	(5)	(8)	[9] 25	(8)	(8)	[9] 9	(8)	(8)	[9] 18	4	4	[9] 7	(8)	(8)	(8)	(8)
Rolling *stony* land (Colbertt soil material)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Rough gullied land																
Apison and Conasauga soil materials	(8)	(8)	(5)	(5)	(8)	(8)	(5)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Limestone residuum	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Rough stony land (Muskingum soil materials)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
Sequatchie fine sandy loam	15	28	40	5	14	20	10	28	40	6	9	1.3	(8)	1.8	2.4	50
Sequatchie loamy fine sand	8	13	18	3	5	8	5	10	15	2	3	5	(8)	(7)	(7)	20
Staser loamy fine sand	20	30	40	4	10	13	8	20	25	5	.7	9	(8)	(7)	(7)	(7)
Stony colluvium (Muskingum soil material)	(8)	(8)	(8)	(5)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(5)	(8)	(8)	(8)
Taft silt loam	8	20	[9] 30	3	9	[9] 13	5	18	[9] 25	5	8	1.1	(8)	(8)	(8)	(7)
Talbott silt loam	18	25	35	10	14	20	20	28	40	9	1.1	1.4	6	2.6	3.4	(7)
Talbott silty clay loam, eroded phase	13	20	30	6	11	16	13	23	33	6	8	1.2	(8)	2.4	3.0	(7)
Upshur silt loam	15	23	30	10	14	18	20	28	35	7	9	1.1	4	2.0	2.8	35
Hilly phase	8	15	25	5	9	13	10	18	25	.4	7	9	(8)	1.6	2.4	30

See footnotes at end of table.

TABLE 7.—*Estimated yields per acre of the principal crops under each of three levels of management, an[illegible] soil of Rhea County, Tenn.*—Continued

Soil	Corn			Wheat			Oats			Lespedeza hay			Alfalfa hay			Strawb[illegible]	
	A[1]	B[2]	C[3]	A	B	C	A	B	C	A	B	C	A	B	C	A	B
	Bu	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*		
Upshur silty clay loam. Eroded phase	10	18	28	6	11	15	13	23	30	4	7	9	(8)	1.6	2.4	30	3[illegible]
Eroded hilly phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	1.2	1.6	(8)	[illegible]
Waynesboro fine sandy loam	18	30	40	8	15	20	15	30	40	8	1.1	1.4	(8)	2.4	3.2	50	5[illegible]
Eroded sloping phase	15	20	30	6	11	16	13	23	33	6	9	1.2	(8)	2.0	2.8	40	4[illegible]
Waynesboro gravelly fine sandy loam	15	25	35	6	11	16	13	23	33	6	8	1.2	(8)	2.2	3.0	40	4[illegible]
Eroded hill phase	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	2	3	6	(8)	1.1	1.4	(8)	[illegible]
Eroded sloping phase	10	15	25	5	8	13	10	15	25	3	7	1.0	(8)	1.8	2.6	30	3[illegible]
Wolftever silt loam	18	25	35	8	13	18	15	25	35	8	1.1	1.4	(8)	2.6	3.4	(7)	[illegible]
Wolftever silty clay loam, eroded sloping phase	8	13	20	4	6	11	8	13	23	2	4	8	(8)	(7)	(7)	(8)	[illegible]

[1] The indexes in columns A refer to yields obtained without the use of amendments or beneficial crop rotation on the specifi[illegible] ductivity Ratings

[2] The indexes in columns B refer to yields obtained under most common practices of management For further details see the [illegible]

[3] The indexes in columns C refer to yields that may be expected under the best practices of management. For further details [illegible]

[4] Crates of 24 quarts each

[5] Cow-acre-days is a term used to express the carrying capacity of pasture land As used here, it is the number of days 1 anim[illegible] to the pasture, or the product of the number of animal units to the acre multiplied by the number of days of grazing. The animal u[illegible] of livestock. It is the equivalent of a mature cow, steer, or horse, or 5 hogs, or 7 sheep or goats. For example, a soil that would s[illegible] or 2 cows, or 2 animal units for 50 days, would rate 100, and a soil that would support only 1 cow, or 1 animal unit on 4 acres for 10[illegible]

[6] This is a classification of soils according to their relative physical suitability for the agriculture of the county. For further deta[illegible]

[7] The crop is not commonly grown, but the soil is considered at least fairly well suited physically to its production.

[8] The crop is not commonly grown, and the soil is considered poorly suited to its production under the management specified.

[9] Yields assuming adequate artificial drainage, it is not assumed that adequate artificial drainage is feasible at all places

[10] Quality of the crop above the average for the county.

In general, the choice of crops is influenced to some extent by the physical suitability of the soil. Rates of application and kinds of fertilizers and other amendments used are usually determined by the crop to which they are applied but with regard to the soil needs as detremined by farm experience. Tillage practices are influenced to some extent by the nature of the soil. Engineering methods of water control are not generally practiced.

Tomatoes, potatoes, string beans, and other vegetables generally receive light applications of complete commercial fertilizer. These may be supplemented or replaced on some farms by the use of manure. Farmers generally make light applications of superphosphate or of low-analysis complete fertilizer at long intervals in the rotation for corn and small grain. Lespedeza, soybeans, and pasture are rarely fertilized or limed. Generally if alfalfa is grown, it receives moderately heavy applications of lime and phosphate at seeding, and management for this crop is probably at a higher level than for other crops commonly grown in the county. This fact is a direct result of the exacting requirements of alfalfa and of the difficulty, or on most soils the impossibility, of obtaining good stands without adequate fertilization and liming.

Soils of the bottom lands are seldom fertilized except for corn or vegetable crops on the Pope, Roane, and Philo soils. The most common management for strawberries is to plow newly cleared land or land that has been idle for a considerable period and grow the plants on it for about 3 years. Most commonly no fertilization is practiced. The strawberries are not mulched and little effort is made to obtain adequate resetting of young plants by breaking out the old rows. Yields commonly decline from the first to the third year under this management; the yields given in column b are estimates of the average of 3 years' production. After the third year, the fields are abandoned or used for unimproved permanent pasture. The yields given in column c are estimates of those obtained under sustained production, or in a rotation, and under adequate fertilization, mulching, and maintenance of new stock.

Crops are rotated to some extent, but rotations are generally not planned with special regard to maintenance of productivity and good tilth. Corn or other intertilled crops are generally grown year after year on soils of the first bottoms. An occasional hay crop or small grain crops may be introduced at relatively long intervals. Corn or other intertilled crops are commonly grown from 1 to 3 years in succession on the soils of the uplands, terraces, and colluvial lands followed for 1 or 2 years by small grain and hay, lespedeza, or soybeans. On the hilly and steep phases of the Fullerton and Clarksville soils, rather long periods of idleness or unimproved low-quality pasture are common between periods of cropping. Strawberries on these and similar soils are commonly grown for several years on newly cleared land, after which the fields are abandoned for considerable periods.

Tillage is approximately on the contour on hilly and steep phases of soils but not on the less steep soils. Terracing, strip cropping, and similar practices are not in general use.

There are two common systems of management for permanent pasture in Rhea County. The first is essentially no management and consists of unregulated grazing of permanent pastures that receive no lime, fertilizer, or manure; excess herbage is not clipped, and droppings are not scattered. The yields given in columns A are estimates of the carrying capacity of such unimproved pastures. The second type of management involves reseeding of soils that have been used for crops that require tillage. These areas are commonly sown to crops, as lespedeza, redtop, orchard grass, and ryegrass, and do not receive amendments after reseeding. Pastures on these areas commonly benefit to a small extent from recent previous applications of lime and phosphorus. Generally such amendments have been light. The reseeding provides pasture plants that are more desirable than those on unimproved permanent pastures. The plants that are reseeded are generally tolerant of low nutrient levels, and although their production would be increased by the use of fertilizers, the grazing capacity is generally above that of unimproved permanent pastures. The yields given in columns B are estimates of the grazing capacity of such pastures, except in the case of soils on which crops that require tillage are not commonly grown. In the latter case yields of columns A and B are identical, and the definition of management for columns B is the same as that for columns A.

The yield data of columns B are based largely on observations, interviews, and local experience of farmers and agricultural workers. Yield data by soil types over a long period of years are used whenever available. It is thought that the summation of local experience will give fairly reliable yield expectations under the management commonly practiced. In some instances where such information was not available, the figures given in this column represent inductive estimates rather than established yields. This applies especially to potatoes, tomatoes, strawberries, and permanent pasture.

In columns C, the yields given are those that represent the estimated yields of crops under good management. Good management refers to proper choice and rotation of crops; correct use of lime, commercial fertilizers, and manure; proper tillage methods; the return of organic matter to the soil; and engineering methods of water control, where necessary, carried on to the end of maintaining or increasing soil productivity.

Although present knowledge of the requirements for good management of specific soils for specific crops is limited, some of the deficiencies of the soils are known within a reasonable degree of certainty, and others are considered to be probable. From this knowledge, some of the requirements of soils are discussed in the subsection on Land Use and Soil Management and the reader should refer to that section for the definition of the level of management for which the yields of columns C are given.

As the management requirements of different crops on the same soil may be different, so also may be the management requirements of the same crop on different soils. Moreover, the point at which it is no longer profitable for a farmer to intensify further the practices that make for good management depends not only on the soil and the

crop but also on the other soils and other crops of the farm, the combination of enterprises of the farm, prices, and numerous other considerations. Therefore the feasible limits of good management are not defined rigidly in this report, both because of lack of knowledge and because of lack of constancy of those limits.

Data on crop yields obtained under conditions that approach good management are scarce. The estimated yields in columns C, therefore, are based largely on the best judgment of men who have had experience with the soils and the crops. Their estimates are based on the responses crops would be expected to make over and above yields commonly obtained (as given in columns B), if the known deficiencies of the soils were corrected to an extent that is within feasible limits. The estimates are subject to errors of judgment not only with respect to the response of crops to corrective management practices on specific soils, but also with respect to the intensity of application of corrective practices that may be feasible under present conditions. They are also subject to errors that are due to a lack of knowledge of deficiencies of minor elements and other deficiencies that might be corrected.

The yields listed in columns C are intended as production goals that may be reached generally by feasible practices of soil and crop management. The same goal can probably be reached on most soils by several different combinations of the management practices suggested in the section on Land Use and Soil Management. Some of these practices may supplement or replace another; others are essential to good management. The best choice depends upon the farm business as a whole. On one farm it may be feasible and desirable to manage the soil in such way that the yields exceed the goal; on others it may not be feasible to reach the goal. The best feasible management for a farm unit may give yields in excess of the goal for one crop on one soil and yields below the goal for another crop on the same soil. The yields listed in columns C should be used in comparison with those listed in columns A and B to give an idea of the response that may be expected of crops under a feasible good level of management.

In table 8 the estimated yields of crops on the soils of Rhea County have been converted into indexes, and the soils have been grouped according to their relative physical suitability for the agriculture of the county under prevailing conditions.

TABLE 8.—*Productivity ratings, workability, and conservability of soils of Rhea County, Tenn., gr*

Physical land classification and soil [1]	Productivity index for [2]—																				
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Oats (100=50 bu.)			Lespedeza hay (100=1½ tons)			Alfalfa hay (100=4 tons)			Strawberries (100=100 24-qt. crates)			Pota (100=2	
	A [3]	B [4]	C [5]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B
First-class soils (good to excellent cropland, good to excellent pasture land) [9]																				
Huntington silt loam	100	100	110	50	55	60	40	50	55	95	95	115	65	70	80	(10)	(10)	(10)	(10)	(10)
Abernathy silt loam	90	90	100	50	55	60	40	45	50	95	95	115	70	75	90	(10)	(10)	(10)	60	60
Emory silt loam	70	80	100	40	80	105	40	80	100	90	90	110	70	75	90	(10)	(10)	(10)	35	55
Etowah silt loam	50	75	100	40	80	105	40	80	100	70	80	100	20	80	100	(10)	(10)	(10)	35	55
Dewey silt loam	50	75	100	40	80	105	40	80	100	70	80	100	20	80	100	(10)	(10)	(10)	35	55
Second-class soils (fair to good cropland, fair to excellent pasture land) [9]																				
Huntington fine sandy loam	80	80	90	45	50	55	35	40	50	90	90	100	60	65	75	(10)	(10)	(10)	60	60
Etowah silty clay loam, eroded phase	40	60	90	30	60	80	30	60	80	60	80	95	(11)	75	95	(10)	(10)	(10)	30	50
Dewey silty clay loam, eroded undulating phase	40	60	90	30	60	80	30	60	80	60	75	95	(11)	75	95	(10)	(10)	(10)	30	50
Cumberland silty clay loam, eroded phase	40	60	90	30	60	80	30	60	80	60	80	95	(11)	75	95	(10)	(10)	(10)	30	50
Waynesboro fine sandy loam	35	60	80	30	60	80	30	60	80	55	75	95	(11)	60	80	50	50	150	25	45
Allen very fine sandy loam	35	55	85	30	40	80	30	40	80	60	80	100	(11)	60	80	50	50	150	25	45
Sequatchie fine sandy loam	30	55	80	20	55	80	20	55	80	40	60	90	(11)	45	60	50	50	150	25	50
Greendale silt loam	40	70	90	35	60	80	35	60	90	50	70	95	(11)	60	80	55	55	160	30	50
Talbott silt loam	35	50	70	40	55	80	40	55	80	60	75	95	15	65	85	(10)	(10)	(10)	20	35
Lindside silt loam	70	80	[12] 100	35	40	[12] 50	35	40	[12] 55	90	90	110	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Ooltewah silt loam	70	80	[12] 100	35	40	[12] 50	35	40	[12] 50	90	90	110	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Egam silty clay loam	70	80	90	40	50	50	35	40	55	80	90	95	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Pope silt loam	50	70	90	45	50	55	35	45	55	50	70	95	(11)	(10)	(10)	(10)	(10)	(10)	25	55
Emory silt loam, sloping phase	65	70	95	30	60	80	30	60	80	75	80	100	65	70	85	(10)	(10)	(10)	30	50
Colbert silt loam, deep phase	35	50	70	40	55	80	40	55	80	55	75	95	15	65	85	(10)	(10)	(10)	20	35
Dewey silty clay loam, eroded phase	35	55	80	25	55	70	25	55	70	55	75	90	(11)	70	90	(10)	(10)	(10)	30	45
Cumberland silty clay loam, eroded sloping phase.	35	55	80	25	55	70	25	55	70	55	75	90	(11)	70	90	(10)	(10)	(10)	30	45
Wolftever silt loam	35	50	70	30	50	70	30	50	70	55	75	95	(11)	65	85	(10)	(10)	(10)	30	50
Fullerton silt loam	35	50	70	30	45	70	30	40	70	40	60	80	(11)	55	75	50	50	150	25	45

Cumberland gravelly fine sandy loam.	35	50	80	30	60	80	30	60	80	40	60	80	(11)	60	80	50	50	150	30	50
Hartsells fine sandy loam	30	50	70	20	35	70	20	35	70	35	55	75	(11)	35	50	50	50	150	20	45
Crossville loam	30	50	70	20	35	70	20	35	70	35	55	75	(11)	35	50	50	50	150	20	45
Roane silt loam	40	70	90	45	50	70	35	45	55	50	70	95	(11)	55	75	50	50	160	25	50
Pope fine sandy loam	40	60	80	40	45	50	30	40	50	40	60	70	(11)	(10)	(10)	(10)	(10)	(10)	25	50
Jefferson very fine sandy loam.	30	50	70	20	35	70	20	35	70	35	55	75	(11)	35	50	40	40	130	15	35
Apison very fine sandy loam	25	45	60	25	35	70	25	35	70	35	55	75	(11)	60	80	35	35	125	20	45
Waynesboro gravelly fine sandy loam.	30	50	70	25	45	65	25	45	65	40	55	80	(11)	55	.75	40	40	140	20	40
Fullerton cherty silt loam, undulating phase.	30	45	65	25	40	70	30	40	65	35	50	70	(11)	50	70	45	45	145	20	40
THIRD-CLASS SOILS (poor to fair cropland, fair to very good pasture land) [9]																				
Staser loamy fine sand	40	60	80	15	40	50	15	40	50	35	50	60	(11)	(10)	(10)	(10)	(10)	(10)	30	45
Holston very fine sandy loam	30	50	70	25	40	70	25	40	70	35	55	75	(11)	35	50	(10)	(10)	(10)	15	35
Nolichucky fine sandy loam	30	50	70	20	35	70	20	35	70	35	55	75	(11)	35	50	40	40	135	15	35
Allen very fine sandy loam, eroded sloping phase	30	45	70	25	35	70	25	35	70	40	55	80	(11)	45	65	35	35	130	20	40
Waynesboro fine sandy loam, eroded sloping phase.	30	40	60	25	45	65	25	45	65	40	60	80	(11)	50	70	40	40	140	20	40
Talbott silty clay loam, eroded phase.	25	40	60	25	45	65	25	45	65	40	55	80	(11)	60	75	(10)	(10)	(10)	15	30
Upshur silt loam	30	45	60	40	55	70	40	55	70	45	60	70	10	50	70	35	35	130	15	30
Greendale cherty silt loam	30	50	75	25	45	80	25	45	80	35	60	80	(11)	55	75	45	45	150	25	45
Fullerton cherty silt loam	25	35	60	25	35	65	25	35	65	35	55	75	(11)	50	90	40	40	135	20	35
Ooltewah fine sandy loam	40	60	[12] 80	30	35	[12] 45	30	35	[12] 45	50	60	70	(11)	(11)	(11)	(10)	(10)	(10)	(10)	(10)
Lindside silty clay loam	50	60	[12] 90	35	40	[12] 50	30	35	[12] 50	80	80	100	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Apison very fine sandy loam, eroded phase	10	25	55	20	30	60	20	30	60	20	35	70	(11)	55	75	30	30	125	15	40
Fullerton cherty silt loam, eroded phase	20	35	60	20	30	50	20	30	45	30	40	70	(11)	45	65	35	35	130	15	35
Hartsells fine sandy loam, rolling phase	25	40	60	20	30	60	20	30	60	30	50	70	(11)	35	45	45	45	145	20	40
Crossville loam, rolling phase	25	40	60	20	30	60	20	30	60	30	50	70	(11)	35	45	45	45	145	20	40
Hanceville fine sandy loam	30	50	70	20	30	60	20	30	60	30	50	70	(11)	35	45	40	40	135	20	40
Conasauga silt loam	20	30	50	30	40	60	30	40	60	35	55	80	10	50	70	(10)	(10)	(10)	15	30
Colbert silt loam	20	30	50	30	40	60	30	40	60	35	55	75	10	50	70	(10)	(10)	(10)	15	30
Taft silt loam	15	40	[12] 60	10	35	[12] 50	10	35	[12] 50	35	55	75	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Upshur silty clay loam, eroded phase	20	35	55	25	45	60	25	45	60	30	50	60	(11)	40	60	30	30	125	10	25
Cumberland gravelly fine sandy loam, eroded sloping phase	30	40	50	20	35	60	20	35	60	35	55	80	(11)	50	70	35	35	130	25	45
Roane gravelly silt loam	20	35	55	20	30	60	20	30	45	30	55	75	(11)	50	70	35	35	125	20	40
Philo silt loam	35	45	[12] 70	25	35	[12] 50	30	40	[12] 50	40	55	70	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)
Philo fine sandy loam	30	40	[12] 60	25	30	[12] 40	25	35	[12] 45	35	50	70	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)

See footnotes at end of table.

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TABLE 8.—*Productivity ratings, workability, and conservability of soils of Rhea County, Tenn., group*

Physical land classification and soil [1]	Productivity index for [2]—																				
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Oats (100=50 bu.)			Lespedeza hay (100=1½ tons)			Alfalfa hay (100=4 tons)			Strawberries (100=100 24-qt. crates)			Potat (100=20	
	A [3]	B [4]	C [5]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B
THIRD-CLASS SOILS—Con.																				
Dewey silty clay loam, eroded hilly phase.	25	40	60	20	35	55	20	35	55	35	50	80	(11)	65	75	(10)	(10)	(10)	(11)	(11)
Etowah silty clay loam, eroded sloping phase.	35	55	80	25	55	70	25	55	70	55	75	90	(11)	70	90	(10)	(10)	(10)	30	45
Clarksville cherty silt loam, undulating phase.	25	35	55	20	35	70	20	35	70	35	40	80	(11)	35	50	40	40	130	15	35
Jefferson very fine sandy loam, eroded sloping phase	20	35	50	15	25	45	15	25	45	20	40	60	(11)	30	45	30	30	120	10	20
Nolichucky fine sandy loam, eroded sloping phase.	20	35	50	15	25	40	15	25	40	20	40	60	(11)	30	45	30	30	120	10	25
Hartsells fine sandy loam, eroded rolling phase.	20	35	50	15	25	45	15	25	45	20	40	60	(11)	30	45	35	35	140	15	35
Clarksville cherty silt loam	20	30	50	20	30	60	20	30	60	30	35	75	(11)	35	50	35	35	125	15	30
Eroded phase	15	25	40	15	25	45	15	25	45	20	35	70	(11)	30	45	30	30	120	10	25
Holston gravelly fine sandy loam.	20	30	40	15	30	60	15	30	60	20	30	55	(11)	30	45	35	35	125	15	30
Jefferson stony fine sandy loam.	20	35	60	20	30	60	20	30	60	30	50	70	(11)	35	45	35	35	125	15	30
Waynesboro gravelly fine sandy loam, eroded sloping phase.	20	30	50	20	30	50	20	30	50	20	50	70	(11)	45	65	30	30	130	15	35
Sequatchie loamy fine sand	15	25	35	10	20	30	10	20	30	15	20	35	(11)	(10)	(10)	20	20	60	(11)	25
Wolftever silty clay loam, eroded sloping phase	15	25	40	15	25	45	15	25	45	15	30	55	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
FOURTH-CLASS SOILS (poor cropland, poor to very good pasture land) [9]																				
Burgin clay loam	25	25	[12] 80	(11)	(11)	(12)	(11)	(11)	(12)	50	55	95	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Dunning silty clay loam (undrained).	20	20	[12] 75	(11)	(11)	(12)	(11)	(11)	(11)	40	50	90	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)

Melvin silt loam	(11)	(11)	[12] 80	(11)	(11)	[12] 45	(11)	(11)	[12] 40	35	40	50	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Upshur silt loam, hilly phase	15	30	50	20	35	50	20	35	50	30	50	60	(11)	45	60	30	30	125	(11)	(11)
Conasauga silty clay loam, eroded phase	15	25	40	20	30	40	20	30	40	20	35	75	(11)	40	50	(10)	(10)	(10)	(11)	(11)
Colbert silty clay loam:																				
Eroded phase	15	25	40	20	30	40	20	30	40	20	35	70	(11)	45	65	(10)	(10)	(10)	(11)	(11)
Eroded rolling phase	10	20	30	15	25	35	15	25	35	20	35	60	(11)	40	50	(10)	(10)	(10)	(11)	(11)
Fullerton cherty silt loam.																				
Hilly phase	20	30	45	20	30	45	20	30	45	30	40	70	(11)	45	65	35	35	125	15	30
Eroded hilly phase	15	20	40	20	25	40	20	25	40	20	35	60	(11)	40	60	30	30	125	15	25
Cumberland silty clay loam, severely eroded sloping phase	(11)	(11)	50	(11)	(11)	50	(11)	(11)	50	(11)	(11)	55	(11)	(11)	50	(11)	(11)	(11)	(11)	(11)
Allen stony fine sandy loam, eroded phase.	25	40	60	20	30	50	20	30	50	30	35	60	(11)	45	65	40	40	135	20	40
Apison very fine sandy loam, eroded rolling phase	10	15	45	15	20	50	15	20	50	15	35	60	(11)	50	70	25	25	120	10	35
Guthrie silt loam	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	30	30	50	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Atkins silt loam (undrained)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Atkins very fine sandy loam (undrained)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(10)	(10)	(10)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Rolling stony land (Colbert soil material).	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Robertsville silt loam	(11)	(11)	50	(11)	(11)	[12] 35	(11)	(11)	[12] 35	30	30	50	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Jefferson stony fine sandy loam, eroded sloping phase.	10	20	35	10	20	40	10	20	40	20	40	60	(11)	30	40	25	25	115	10	20
Clarksville cherty silt loam																				
Hilly phase	15	25	40	15	25	40	15	25	40	20	35	70	(11)	30	45	30	30	120	10	25
Eroded hilly phase	10	20	35	15	20	35	15	20	35	15	30	60	(11)	25	40	25	25	115	10	20
Cumberland gravelly fine sandy loam, eroded hill phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	30	35	70	(11)	30	40	(11)	(11)	(11)	(11)	(11)
Waynesboro gravelly fine sandy loam, eroded hill phase.	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	15	20	40	(11)	25	35	(11)	(11)	(11)	(11)	(11)
Dewey silty clay loam, severely eroded hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	50	(11)	(11)	40	(11)	(11)	(11)	(11)	(11)
Fullerton cherty silt loam, severely eroded phase.	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	50	(11)	(11)	40	(11)	(11)	(11)	(11)	(11)
Pope loamy fine sand	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	25

See footnotes at end of table.

TABLE 8.—*Productivity ratings, workability, and conservability of soils of Rhea County, Tenn., group-*

Physical land classification and soil [1]	Productivity index for [2]—																			
	Corn (100=50 bu.)			Wheat (100=25 bu.)			Oats (100=50 bu.)			Lespedeza hay (100=1½ tons)			Alfalfa hay (100=4 tons)			Strawberries (100=100 24-qt. crates)			Potat (100=20	
	A [3]	B [4]	C [5]	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B
FIFTH-CLASS SOILS (very poor cropland, poor to very poor pasture land) [9]																				
Upshur silty clay loam, eroded hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	30	40	(11)	(11)	(11)	(11)	(11)
Apison very fine sandy loam, severely eroded rolling phase.	(11)	(11)	40	(11)	(11)	45	(11)	(11)	45	(11)	(11)	50	(11)	45	65	(11)	(11)	(11)	(11)	(11)
Fullerton cherty silt loam																				
Eroded steep phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Severely eroded hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	40	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Muskingum stony fine sandy loam, rolling phase.	10	20	30	10	20	40	10	20	40	20	35	50	(11)	(11)	(11)	25	25	115	15	30
Conasauga silty clay loam, severely eroded phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Clarksville cherty silt loam, eroded steep phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Hector stony fine sandy loam	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Muskingum stony fine sandy loam, hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Hector fine sandy loam, eroded phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Muskingum stony fine sandy loam, eroded hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Stony colluvium (Muskingum soil material)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Montevallo silt loam, hilly phase	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Rough gullied land (limestone residuum)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Muskingum stony fine sandy loam	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)

Rough gullied land (Apison and Conasauga soil materials).	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Rough stony land (Muskingum soil material).	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Limestone outcrop	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)
Mines, pits, and dumps	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)	(11)

[1] Soils are listed approximately in the decreasing order of relative physical suitability for the agriculture of the county under

[2] Each index is the expected yield expressed as percent of a standard yield of each crop The standard yield of each crop is lis sents the approximate acreage yield obtained without the use of fertilizer or other amendments on the more extensive and bett crop is most commonly grown

[3] The indexes in columns A refer to yields obtained without the use of amendments or beneficial crop rotation on the specified tivity Ratings

[4] The indexes in columns B refer to yields obtained under most common practices of management For further details see t

[5] The indexes in columns C refer to yields that may be expected under the best practices of management For further detai

[6] Cow-acre-days is a term used to express the carrying capacity of pasture land As used here, it represents the number of da injury to the pasture, or the product of the number of animal units to the acre multiplied by the number of days of grazing The a ments of livestock It is the equivalent of 1 mature cow, steer, or horse, or 5 hogs, or 7 sheep or goats For example, a soil that w days, or 2 cows, or 2 animal units for 50 days, would rate 100, and a soil that would support only 1 cow or 1 animal unit on 4 ac

[7] Workability refers to the ease of tillage, harvesting, and other field operations Relative descriptive terms, in decreasing ord are: Excellent, very good, good, fair, poor, and very poor For further details see the section on Productivity Ratings

[8] Conservability refers to the ease with which productivity and workability can be maintained or improved Relative desc ability, are Excellent, very good, good, fair, poor, and very poor For further details see the section on Productivity Ratings

[9] This is a classification of soils according to relative physical suitability for the agriculture of the county For further details see

[10] The crop is not commonly grown, but the soil is considered at least fairly well suited physically to its production.

[11] The crop is not commonly grown, and the soil is considered poorly suited to its production under the management specified

[12] Yields, assuming adequate artificial drainage, it is not assumed that adequate artificial drainage is feasible at all places.

[13] Quality of the crop above the average of the county.

Each rating compares the productivity of each soil for each crop under each level of management with a standard yield for the crop. This standard index of 100 represents the approximate average acre yield obtained without the use of fertilizers or other amendments on the more extensive and better soils of the region in the United States where the crop is most widely grown. An index of 50 indicates that the soil is about half as productive of the specified crop under the specified level of management as the soil with the standard index. The indexes of some soils that are well managed or are unusually productive may be more than 100 for some crops.

The productivity indexes of table 8 are the estimated yields of table 7 expressed as percent of the standard yields adopted for the crop in the United States. The standard yields on which the indexes are based are indicated in the table under the names of the crops for which the ratings are given. Columns A, B, and C under each crop refer to three levels of soil management and correspond to similar columns in the table of estimated yields for which levels of management are defined.

The soils have been placed in the productivity rating table in the approximate order of their general relative physical suitability for the agriculture of the county under prevailing conditions. This has been done chiefly on the basis of information acquired through field observation and consultation with farmers in the county and with competent agricultural workers in the State.

The table gives a characterization of the productivity and relative desirability of the soils, but it does not present the relative roles that the soils play in the agriculture of the county. The ratings cannot be interpreted directly into land values. Distance to market, relative prices of farm products, association with other soils of different capability, and many other factors influence the values of soils at certain places. The indexes can be used for comparison of productivity of specific crops (1) on different soils under similar levels of management, (2) on the same soil under different levels of management, and (3) on soils of this county and on soils of other parts of the United States. Other uses are to show the response of crops that can be expected from different levels of management on the various soils of the county; in connection with other information to make estimates of the total production of crops by soil areas and of their total productive capacity; to provide part of the information necessary in arriving at land values; and to serve as guides in many problems concerning agriculture, but they are usually most useful in conjunction with other information relative to these problems.

FORESTS [15]

The demands of the early settlers on the forests were limited chiefly to the local needs for houses, furniture, fences, implements, and tools. Not all the timber cut to provide land for crops could be used. Prior to the completion of the Cincinnati Southern Railroad in 1880, the Tennessee River was the avenue of exportation of lumber and forest products, particularly after regular steam navigation was inaugurated on the upper Tennessee River about 1835 (*3*). The advent of the rail-

[15] This section was prepared by G. B. Shivery, extension forester, University of Tennessee.

road brought about a decided shift from an economy based on river transportation and was followed by the establishment of woodworking plants, particularly at Dayton and Spring City (*1*). The production of fruits, especially strawberries, was instrumental in the establishment by the Dayton Veneer and Lumber Company of a plant, destroyed by fire in 1939, using gum, elm, poplar, and hickory logs to manufacture veneer packages for fruits and vegetables. The railroad had provided means of shipment, and the central ridges of the Clarksville-Fullerton soil association were cleared for strawberries. During the depression years shipments decreased, with the result that much hill land was left untended to erode.[16]

By 1909, 16 operating sawmills were in the county, but none was cutting more than 5,000 million board feet of lumber (*4*). The supply of good merchantable timber is now almost completely exhausted, except for local inaccessible areas on the Cumberland Plateau. Aside from 2 large concentration yards at Spring City, 31 sawmills were listed in the county in 1940, but they were small and operated only occasionally (fig. 20). During the decade beginning in 1930 the majority of the small country sawmills had a capacity on the days they operated of 2 to 4 million board feet, consisting of cross ties and lumber. The 1940 production amounted to 10,450 million board feet of pine, 1,370 million board feet of hardwood, and 16,000 pieces of poles and pole stubs.[17] Of the county's land area, 121,230 acres are classed as forest (fig. 21); 79,620 as nonforest, and 13,580 acres as water.[18] According to the 1940 census, 54.6 percent of the total land area is in farms, of which 34 percent is farm woodland, an average of 32 acres to the farm.

Three broad classes, with seven subclasses, of forest types are present in Rhea County, as follows: (1) Hardwood types—blackjack oak-hardwoods and upland hardwood; (2) coniferous types—yellow pine and hemlock-white pine; and (3) mixed types—yellow pine-hardwood, hemlock-hardwood, and white pine-hardwood.

1. The hardwood types are in pure or mixed stands and in stands of mixed hardwood and coniferous species in which more than 75 percent of the dominant and codominant trees are hardwoods.

The blackjack oak-hardwood type consists chiefly of blackjack, post, and scarlet oaks, hickories, black gum, white oak, occasionally other oaks, shortleaf pine, sourwood, maple, and dogwood. The stands are mainly on dry sites, and the size and quality of timber is generally not acceptable for saw timber. This type occurs on the Hartsells-Muskingum soil association of the Appalachian Plateaus physiographic province. About 38 percent of the total forested area consists of this particular forest type, of which 27,450 acres is classed as cordwood and 18,150 acres as below cordwood, with none considered saw-timber size.[19]

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[16] TENNESSEE VALLEY AUTHORITY and CIVIL WORKS COMMISSION. AGRICULTURAL-INDUSTRIAL SURVEY 158 pp., illus 1934. [Typewritten.]

[17] Forestry Relations Department, Tennessee Valley Authority.

[18] See footnote 5, p. 10

[19] Condition classes: (*a*) Saw timber: Stands containing at least 500 board feet an acre, gross volume, of trees of saw-timber size; hardwoods 13 inches and over and, conifers 9 inches and over; diameter, breast high. (*b*) Cordwood: Stands containing less than 500 board feet an acre, gross volume, of trees of saw-timber size and 4 cords or more to the acre in cordwood size; hardwoods 5 to 13 inches and conifers 5 to 9 inches; diameter, breast high. (*c*) Below cordwood: Stands containing less than 500 board feet an acre, gross volume, of trees of saw-timber size and less than 4 cords to the average acre in cordwood size,

FIGURE 20.—The rougher, less arable sections of the county afford a source of both hardwood and
local mills. This mill is at Spring City. Practically all the forest land has been

FIGURE 21.—About 121,000 acres, or 57 percent of Rhea County is in hardwood, mixed pine and ha
pine forest. A large part of the Muskingum soils, which predominate in this picture, 2 miles

The upland hardwood type consists principally of mixed oaks, hickories, yellow poplar, black gum, basswood, and occasional yellow pine. It exists mainly in mountainous or hilly areas on moist sites, usually on loamy well-drained soils, and constitutes about 15 percent of the forested area of the county. About 3,750 acres is in saw timber, 17,190 in cordwood, and 1,310 acres below cordwood size. The chief occurrence is on the Clarksville-Fullerton soil association and to a limited extent on north- and east-facing slopes and moist sites along the streams of the Cumberland Plateau.

2. Coniferous types are stands composed of coniferous species that make up 75 percent or more of the number of dominant and codominant trees.

The yellow pine type consists of stands in which yellow pines form at least 75 percent of the total dominant and codominant stems. The trees are chiefly shortleaf pine, but Virginia pine also is included. The chief occurrence is on dry upland and ridges, often on old fields. It is of limited acreage, consisting of 400 acres of saw timber, 180 acres of cordwood, and 130 acres of below cordwood size. It may occur on any of the locations described for yellow pine-hardwood where shortleaf pine, Virginia pine, or both compose at least 75 percent of the stand. It is on old fields formerly in cultivation but now abandoned.

The hemlock-white pine type consists of stands in which hemlock and white pine are the only species or are predominant, but in which neither constitutes more than 75 percent nor less than 25 percent of the total number of dominant and codominant stems. It occurs chiefly in cool, moist situations in ravines and on north-facing slopes at 1,000 to 4,000 feet elevation. It is found in cool, moist places along the streams at the bottoms of the steep V-shaped valleys and troughs of the Muskingum-rough stony land soil association of the Cumberland Plateau. Of the forested area of the county, 4 percent is included in this forest type, and 3,140 acres is classed as saw timber and 1,640 acres as cordwood size.

3. Mixed types are stands of mixed conifers and hardwoods in which conifers compose between 25 and 75 percent of the number of dominant and codominant trees.

The yellow pine-hardwood type consists of stands of mixed yellow pines and hardwoods in which the pines comprise between 25 and 75 percent of the total dominant and codominant stems. Occasionally this type may contain chestnut. It is present both in the Appalachian Plateaus province and in the Valley and Ridge province and constitutes 37 percent of the forested area. About 13,220 acres is classed as saw timber, 30,570 as cordwood, and 570 as below cordwood size. The yellow pines, shortleaf and Virginia, comprise a sufficient number of dominant and codominant stems on the Cumberland escarpment, the escarpments along Roaring Creek above Graysville, the steep slopes of Piney River and White Creek, and particularly south- and west-facing slopes of the Appalachian Plateau province to be classed as the yellow pine-hardwood forest type. Both the Jefferson-Clarksville-Upshur and the Talbott-Allen-Lindside soil associations of the Valley and Ridge province support stands predominantly of this forest type, and it also occupies an area from Dayton to the Tennessee River at the Hamilton County line that includes the southwestern extremity of the Fullerton-Clarksville soil association. It likewise composes the bulk

of the forest between Piney River and White Creek on the Muskingum-Apison, the Fullerton-Clarksville, the Talbott-Colbert-Waynesboro, and the Clarksville-Jefferson-Upshur soil associations. East of the railway northeast of Evensville this forest type loops from the Talbott-Allen-Lindside association, on the Fullerton-Clarksville, then back to the railroad to join a land area about 1½ miles wide and 3 miles long west of Piney River near Spring City on the Fullerton-Clarksville and the Talbott-Colbert-Waynesboro soil associations. Restricted areas also occur on the three inside bends of the river between Watts Bar Dam and the junction of Richland Creek on the Talbott-Colbert-Waynesboro soil association.

The hemlock-hardwood type consists of stands in which hemlock constitutes 25 to 75 percent of the total dominant and codominant stems. It is of limited extent.

The white pine-hardwood forest type, like that hemlock-white pine type, is associated with the troughs of the Muskingum-rough stony land soil association and is a gradation type midway between the troughs proper of the Muskingum-rough stony land soil association and the smooth, undulating, or rolling lands of the Hartsells-Muskingum soil association. "Gulfs," as well as north- and east-facing slopes, supply the cool and moist situations where pine, often with some hemlock, occurs in mixture with yellow poplar (tuliptree), beech, northern red oak, basswood, hard maple, buckeye, and other hardwoods. The type makes up 3 percent of the total forested area in the county, and 1,440 acres is classed as saw timber and 2,140 acres as cordwood.

The first essential of management of the extensive areas of forest and woodland in Rhea County is prevention of forest fires. The majority of fires on the Cumberland Plateau are purposely set for range burning. The prevailing system of open range is responsible for this practice of wholesale burning, which would be immeasurably decreased were a "fence" law in operation. Currently about 50,000 acres of forest land, mostly on the Cumberland Plateau and escarpment, is organized for fire protection.[20] The fire towers overlooking this land in Rhea County are Grandview Tower near Grandview, St. Johns Tower on the ridge between Dayton and Pikeville about 1 mile south of State highway No. 30, and Rockwood Tower on the mountain above Rockwood. Two motorized units are on duty during fire seasons aside from the three lookouts in these towers. Records for the past 10 years for this organized area indicate an average of 36 fires each year, on 6,811 acres, of which 56 percent are set purposely, 18 percent are chargeable to hunters, 11 percent to smokers, 8 percent to brush burning, 3 percent to lumbering operations, 2 percent to campers, and 2 percent to miscellaneous causes.

Shortleaf pine is a very valuable and important component of the yellow pine-hardwood and the yellow pine forest types. This species occurs sparingly on the blackjack oak-hardwood forest type where forest management should be directed towards its increase. Aside from the demand for softwood lumber, the close-grained pine, such as grows on the Cumberland Plateau and escarpment, is especially suitable for poles and pole stubs, which are treated with creosote under

[20] Division of Forestry, Tennessee Department of Conservation, unpublished county records for 1942.

pressure prior to being placed in service. White pine likewise should be encouraged on those sites where it is native, as should the better oaks, yellow poplar, and similar species suitable for the soil and physiography. These are in places where they will produce marketable timber.

The principle of selective logging needs to be practiced. It is a partial cutting aimed at increasing present profits, yet perpetuating and improving the forest for the future. The farmer, in contrast to the large forest landowner, has an additional opportunity to improve his woodland materially by using cull timber for fuel and other minor farm needs. Such improvement resolves into systematic cutting and use of crooked trees, short limby individuals, unsound trees, slow growers, and poor kinds not in market demand, and reserving the straight tall well-crowned stems that are free from defect for growth into final crop timber. Grazing of these farm woodlands by livestock gradually destroys their timber-producing capacity, and prevents the natural regeneration of the stand. Old-field stands of shortleaf and Virginia pine can often be thinned during their early life, and trees removed can be sold as pulpwood. The choice pine trees left will respond with more rapid growth to form an ultimate supply of saw timber and poles.

Occasions arise when it is necessary to resort to forest-tree planting, particularly on soils that have been cropped or pastured but are now poorly suited to both of these uses. Every situation presents a specific problem. The technique of tree planting to insure success includes advance preparation of the soil and certain other essentials, which should be agreed upon with the landowner at the time a preliminary examination of the areas is made. Advance preparation includes such measures as breaking and mulching galled areas, building simple low brush check dams in gullies, and plowing contour furrows. In the case of severely gullied areas destroyed by sheet and gully erosion, labor-consuming preparation is involved, and labor has been supplied through the agencies of the Tennessee Valley Authority and the Civilian Conservation Corps in some instances, with the result that during the period 1936–41, 69 projects involving 526 acres were planted on private lands, using seedling stock of black locust, shortleaf pine, and loblolly pine.[21] On areas involving a lesser degree of advance preparation, the landowner himself is encouraged to do the entire job, using forest-tree seedlings provided without cost by the Tennessee Valley Authority. Under this arrangement, through the medium of county agricultural agents during the period 1936–42, 142 projects involving 545 acres were successfully completed. On lands owned by the Tennessee Valley Authority, 67 projects including a total of 1,215 acres were completed between 1938 and 1941.

Experience proves that the kind of trees to be planted on an area should be carefully correlated with the soil. Generally, yellow pines, either shortleaf or loblolly, should be given first consideration. Black locust does well in gullies in the moist, well-aerated soil accumulated behind simply constructed check dams. Aside from such sites, black locust is not recommended on eroded lands except where there is intensive land preparation and fertilization with phosphate. With this

[21] From tree planting records of the Watershed Protection Division, Forestry Relations Department, Tennessee Valley Authority.

advance preparation one would expect better results on severely eroded phases of Dewey and Fullerton soils than on similar phases of Clarksville. Rough gullied land (Apison and Conasauga soil materials), limestone outcrop, and rough gullied land (limestone residuum) are primarily land-reclamation problems in connection with which black locust is a valuable ally. Shortleaf pine is well suited to such soil types as Fullerton cherty silt loam, severely eroded hilly phase and eroded steep phase; Clarksville cherty silt loam, eroded steep phase; Upshur silty clay loam, eroded hilly phase; Hector stony fine sandy loam; Hector fine sandy loam, eroded phase; Muskingum stony fine sandy loam; and Pope loamy fine sand. Under such severe growing conditions as are encountered on Muskingum stony fine sandy loam; Muskingum stony fine sandy loam, hilly phase; Muskingum stony fine sandy loam, eroded hilly phase; rough stony land (Muskingum soil material); and stony colluvium (Muskingum soil material), the goal should be the fostering of shortleaf pine seed trees, so that seed from the cones can be disseminated by the wind during early fall to bring about reproduction by natural means of potential pole and small saw-log timber. Soils like Apison very fine sandy loam, eroded rolling and severely eroded rolling phases; Allen stony fine sandy loam, eroded phase; Jefferson stony fine sandy loam, eroded sloping phase; and Montevallo silt loam, hilly phase, are well suited to the growth of loblolly pine.

MORPHOLOGY AND GENESIS OF SOILS[22]

Soil is the product of the forces of weathering and soil development acting on materials deposited or accumulated by geologic agencies. Its characteristics at any given point depend on (1) the physical and mineralogical composition of the parent soil material; (2) the climate under which that material accumulated and has since existed; (3) the plant and animal life in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material. External climate is less important in its effects on soil development than internal soil climate, which depends not only on temperature, rainfall, and humidity, but on the physical characteristics of the soil or soil material and the relief. The relief, in turn, strongly influences drainage, aeration, runoff, erosion, and exposure to sun and wind.

Climate and vegetation are the active factors of soil genesis. They exert their influences on the parent material and change it from a heterogeneous inert mass to a body that has a definite genetic morphology. The effects of climate and vegetation on the parent material are affected to varying degrees by the modifying influence of relief as it affects such conditions as drainage, the quantity of water that percolates through the soil, the rate of natural erosion, and the vegetation itself. The nature of the parent material also influences the course of action that results from the forces of climate and vegetation and is important in determining internal soil climate and the kinds of vegetation that will grow on the soil. Finally, time is involved in the changes that take place, and age becomes a factor of soil genesis

[22] This section was prepared by M. G. Cline, associate soil scientist, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture.

as it reflects the degree of development of the soil into a body that is in equilibrium with its environment. The degree of such development depends not only on time, but also on the rate of action of the forces of climate and vegetation as that rate is affected by the factors of relief and parent material.

The factors of soil genesis are so closely interrelated in their effects on the soil that few generalizations can be made regarding the influence of any one unless conditions are specified for the other four. They are so complex in their interrelations that many of the processes that take place in the development of soils are unknown.

The purpose of this section is to present the outstanding morphological characteristics of the soils of Rhea County and to relate them to the factors of soil formation. Physical and chemical data are limited for these soils, and the discussion of soil genesis and morphology is correspondingly incomplete. The first part of the section deals with the environment under which the soils exist; the second, with specific soil series and the part environment has played in determining the morphology of the soils of these series.

GENERAL ENVIRONMENT AND MORPHOLOGY OF SOILS

The parent materials of soils of Rhea County may be considered in two broad classes: (1) Materials residual from the weathering of rocks in place; and (2) materials transported by water or gravity and laid down as unconsolidated deposits of clay, silt, sand, and large rock fragments. Materials of the first class are related directly to the underlying rocks from which they were derived; materials of the second class, to the soils or rocks from which they were washed or fell.

The residual parent materials are the residuum from the weathering of consolidated sedimentary rocks—limestones, shales, and sandstones; and their character is strongly reflected in many of the characteristics of the soils developed from them. Geologically, the rocks were laid down as unconsolidated sediments that were gradually converted into consolidated rocks. Those of the Cumberland Plateau are almost level-bedded, but those of the Valley and Ridge province are folded and faulted and generally have a pronounced dip.

In the Valley and Ridge province, certain soils developed from residual materials are generally associated with particular rock formations or parts of rock formations. Soils of the Dewey series are commonly associated with high-grade limestones of the Conasauga formation of the Cambrian system or of the Chickamauga group of the Ordovician system. Fullerton and Clarksville soils generally overlie rocks of the Knox dolomite formation, but Clarksville soils may be associated also with Fort Payne chert of the Mississippian system. Talbott and Colbert soils are commonly underlain by argillaceous limestones of the Chickamauga formation of the Ordovician system. Conasauga soils are commonly associated with the Conasauga shales of the Cambrian system. Upshur soils may be associated with the Silurian Clinton shale and the Ordovician Sequatchie formation among others. Apison soils are commonly underlain by members of the Rome formation of the Cambrian system.[23]

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[23] Information regarding surface geology was taken from the geologic map of Watts Bar Reservoir compiled by the Water Control Planning Department of the Tennessee Valley Authority.

On the Cumberland Plateau, Walden sandstone of the Pennsylvanian system and Lookout sandstone of the Mississippian system are the principal formations that give rise to soils of appreciable areal extent (*10*). Soils of the Muskingum series commonly overlie rocks of the Walden sandstone and Lookout sandstone formations of the Cumberland Plateau. They are mapped at a few places in the Valley and Ridge province over members of the Rome formation. Hartsells and Crossville soils are generally underlain by members of the Walden sandstone formation. The rock formations from which Montevallo, Hector, and Hanceville soils are derived have not been determined for this county, and the soils are not necessarily confined to exposures of the formations mentioned.

Also, the kinds of transported materials are reflected in some of the characteristics of the soils derived from them. Soils of the Allen, Jefferson, Holston, Waynesboro, Nolichucky, Sequatchie, Pope, Philo, and Atkins series are derived from transported materials that consist mainly of sandstone and shale and products of their decomposition. Soils of the Greendale, Emory, Abernathy, Ooltewah, Guthrie, Burgin, Cumberland, Etowah, Wolftever, Taft, Robertsville, Huntington, Egam, Roane, Lindside, Melvin, and Dunning series are derived from transported materials that consist mainly of limestone and products of limestone decomposition.

Although a rather consistent relation exists between the kinds of parent materials and some of the characteristics of soils, other soil characteristics, especially those of regional significance from the standpoint of soil genesis, cannot be correlated with kinds of parent material and must be attributed to other factors.

The climate of Rhea County is temperate and continental (see the section on Climate). It is characterized by long warm summers, short mild winters, and relatively high rainfall. The moderately high temperatures favor rapid chemical reactions under the moist conditions that exist in the soil most of the time. The high rainfall favors rather intense and complete leaching from the soil of soluble materials, such as bases, and the downward translocation of less soluble materials and colloidal matter. The fact that the soil is frozen for only short periods and to only shallow depths, further intensifies the degree of weathering and translocation of materials.

Climatic conditions vary somewhat within the county. The Cumberland Plateau is cooler than the rest of the county; the growing season is almost 20 days shorter, and the soil is frozen for longer periods. Doubtless some of the differences between the soils of the Cumberland Plateau and those of the Valley and Ridge province result from differences in climate, but they are also associated with marked differences in parent material, and the separate influences of the two factors have not been determined. It is probable that the differences caused by climate are subordinate to those caused by parent material.

The climate of the part of the Valley and Ridge province in this county is relatively uniform from place to place. The same is true of the climate of that part of the Cumberland Plateau. Within each of these areas, differences of climate cannot be correlated with differences among the soils. The climate of each area can account in part

for some of the outstanding characteristics that many of the soils have in common.

Higher plants, micro-organisms, earthworms, and other forms of the life on and in the soil contribute to its morphology. The nature of the changes they bring about depends, among other things, on the kinds of life and the life processes peculiar to each. The kinds of plants and animals that live on and in the soil are determined by other organisms, climate, parent material, relief, age of soil, and by many other environmental factors. The influence of climate is most apparent, although not always most important, as a determinant of the kinds of higher plants that will grow on the well-drained and well-developed soils. In this way climate exerts a powerful indirect influence on the morphology of soils. Climate and vegetation acting together are the active factors of soil genesis.

A general oak-hickory-chestnut forest association was on all the well-drained, well-developed soils of the county as nearly as can be determined (see the sections on Vegetation and on Forests). There were probably differences in the density of stands, the relative proportions of species, and the associated ground cover, some of the greater differences in these respects being between the Cumberland Plateau and the Valley and Ridge province, because not only of differences in climate but also of differences in the kinds of soil developed. Few marked differences in morphology among the well-drained, well-developed soils, however, appear to be directly the result of differences in the vegetative cover.

The trees that commonly grow in this area, most of which shed their leaves annually, are moderately deep to deep feeders on plant nutrients. The plant-nutrient content of the leaves varies considerably between the different species, but in general the quantities of bases and phosphorus returned to the soil in leaves of deciduous plants is high as compared with those returned by coniferous trees. In this way essential plant nutrients are returned to the upper part of the soil from the lower part and retard the depleting action of percolating waters.

Most of the organic material in the form of dead leaves, twigs, roots, and entire plants, is added to the topmost part of the soil, where it is acted upon by micro-organisms, earthworms, and other forms of life and by direct chemical reactions. The rate of decomposition is rather rapid as a result of the favorable temperature and moisture conditions, favorable character of the organic material itself, and presumably favorable micropopulation of the soil. Organic material does not accumulate on well-drained sites in this county to the extent that it does in cooler regions under similar conditions of drainage.

Little is known of the effect of micro-organisms, earthworms, and other animal life on the soil, but their importance is probably no less than that of the higher plants.

The well-drained, well-developed soils of the county have been formed under relatively similar conditions of climate and vegetation. It is on these soils that there has been a maximum of influence by climate and vegetation and a minimum of modification by relief and age. As a result, the soils developed from various kinds of parent material have many characteristics in common. In the virgin condition, all these soils have a surface layer of organic debris in varying

stages of decomposition. All have A_1 and A_2 horizons that are lighter in color than either the B_1 or the B_2. The B horizon is generally uniformly yellow, brown, or red and is heavier textured than the A_1 or A_2. The C horizon is variable in color and texture among the different soils, but it is usually light red or yellow mottled with gray or brown.

Analysis of samples of a number of comparable soils from Jefferson County, Tenn., may be expected to apply to those of Rhea County (*7*). In the former, the silica content decreases and the alumina and iron content increases with depth. The content of organic matter is moderate in the A_1 horizon, less in the A_2, and very low in the B and C horizons. The soils are low in bases and phosphorus within the solum. In general the loss of ignition is low, indicating a low content of very tightly held water. The reaction is medium, strongly, or very strongly acid throughout the solum. In general, the quantity of silt decreases and the content of clay and colloid increases with depth from the A_1 horizon through the C. The colloid content in the B horizon is much higher than in the A_2.

The soils of Rhea County range from slightly acid to strongly acid. Table 9 gives the pH values for some of the important soils in this county.

TABLE 9.—*pH determinations on several soil profiles from Rhea County, Tenn.*[1]

Soil type and sample No	Depth	pH	Soil type and sample No	Depth	pH
Dewey silt loam	*Inches*		Waynesboro fine sandy loam	*Inches*	
403114	0–2	6.1	403168	0–6	4.9
403115	2–12	4.9	403169	6–14	4.9
403116	12–18	4.6	403170	14–24	4.8
403117	18–30	4.5	403171	24–46	4.6
403118	30–40	4.3	403172	46+	5.1
403119	40+	4.5	Nolichucky fine sandy loam		
Cumberland silt loam			403190	0–8	5.2
403163	0–6	4.8	403191	8–11	4.9
403164	6–20	5.0	403192	11–24	4.3
403165	20–44	4.6	403193	24+	4.8
403166	44–60	4.2			
403167	60+	4.7			

[1] Determinations made by the glass-electrode method by E. H. Bailey, analyst, Soil and Fertilizer Investigations, Bureau of Plant Industry, Soils, and Agricultural Engineering.

The characteristics mentioned are common to all well-developed, well-drained soils that have been subjected to similar conditions of climate and vegetation. They are, therefore, common to soils of zonal extent, and all soils that exhibit them can be called zonal soils. Zonal soils are members of one of the classes of the highest category in soil classification and are defined as "those great groups of soils having well-developed soil characteristics that reflect the influence of the active factors of soil genesis—climate and living organisms" (*9*).

Where the parent materials have been in place a long time and have not been subject to extreme conditions of relief or parent material, the soils that have developed in some places have the characteristics of zonal soils. Where the parent material has been in place only a short time, as in the case of very recently deposited transported materials, the soils have very poorly defined or no genetic horizons. These soils are young and have few or none of the characteristics of zonal soils and, therefore, are called azonal soils (*6*). Azonal soils are members of a second class of the highest category of soil classifica-

tion and are defined as a group "without well-developed soil characteristics either because of their youth or because of conditions of parent material or relief that have prevented the development of definite soil characteristics" (*9*).

The azonal soils are characterized by A_1 horizons that are moderately dark to very dark and apparently have a moderate to fairly high content of organic matter; by the absence of a zone of alluviation, or B horizon; and by a parent material that is usually lighter in color than the A_1 horizon and that in texture may be similar to or lighter or heavier than A_1. Because of the absence of a B horizon they may be referred to as AC soils.

The relief of soils of the county ranges from level to steep. On some steep areas where the quantity of water that percolates through the soil is relatively small and where a large quantity runs off and the rate of that runoff is rapid and contributes to relatively rapid geological erosion, the soils are young. The materials are constantly renewed or mixed, and the changes brought about by vegetation and climate may be so slight that the soils are essentially AC soils. These soils are also azonal soils.

On some nearly level areas where both internal and external drainage are restricted or where geologic erosion is very slow, soils whose materials have been in place a long time have certain well-developed profile characteristics that zonal soils do not have. Such soils are associated geographically with the zonal soils and are called intrazonal soils (*6*). They are defined as soils with "more or less well-developed soil characteristics that reflect the dominating influence of some local factor of relief, parent material, or age, over the normal effect of climate and vegetation" (*9, p. 981*). The characteristics of such soils in this county are generally the result of level relief influenced greatly by the character of the parent material and the kinds of vegetation that grow in such environments.

Soils of each of the three broad classes—zonal, azonal, and intrazonal—may be derived from similar kinds of parent material. Within any one of these classes the major differences among soils appear to be closely related to differences in the kinds of parent material from which derived. The thickness of soils developed from residual materials over the rock from which derived is a factor in the resistance of the rock to weathering, the volume of the residue after weathering, and the rate of geological erosion. The chemical and physical nature of the parent material modifies the rate and direction of chemical changes that result from climate and vegetation and also exerts a pronounced influence on the kinds of vegetation that can be supported on the soil.

Rocks have contributed to differences among soils also through their effects on relief. The rocks of much of the county are of very old formations that are folded and faulted. The present relief is probably largely a product of geologic weathering and erosion of these formations—the higher lands are capped by the more resistant rocks, and the valleys are underlain by those less resistant. The ridges are capped either by cherty dolomitic limestone, interbedded sandstone and shale, or sandstone; and the valleys are underlain by argillaceous and shaly limestones or by more or less pure shales.

The character of the soils developed from residual materials is closely related to the underlying rocks; therefore, the distribution of soils is also related to the valleys and ridges. Dewey, Colbert, Talbott, Conasauga, and Apison soils are chiefly in the valleys; Clarksville, Fullerton, Upshur, Hartsells, Muskingum, Hanceville, and Hector soils are chiefly on the ridges and mountains. Streams in the ridges and mountains generally have steeper gradients than those in the valleys, and, as a result of faster stream cutting and greater relief from the stream floors to the interfluves, many of the soils of the ridges and mountains have steeper slopes than those of the valleys. Some soils on the interfluves have mild slopes. In this way, the character of the rock has contributed indirectly to the character of some soils through relief.

In the limestone areas, the internal drainage of soils of nearly level relief is exceptionally good as a result of good subterranean drainage through caverns and crevices in the sharply dipping rocks. This excellent subterranean drainage counteracts the usual effects of level relief on drainage and allows the nature of the parent rock to dominate in determining local differences among the well-developed, well-drained soils derived from residual materials—soils that are subject to similar forces of climate and vegetation.

GREAT SOILS GROUP

In the following pages the soil series of Rhea County are classified by soil orders and great soil groups. The morphology and genesis of the soils of each series are discussed and some of their similarities and differences are pointed out to show their relations to soils of other series of the same great soil group. The classification of soil series in higher categories is based on limited data, principally on characteristics observable in the field; the correct classification of some is not known; that of others is reasonably well known. An attempt has been made to place each series in the correct great soil group, but further study may make modifications necessary in some instances.

Rhea County is in the region of Red and Yellow Podzolic soils. The zonal order is represented by soils of both the Red Podzolic and Yellow Podzolic great soil groups; the intrazonal order by soils of the Planosol and Half Bog great soil groups; and the azonal order by soils of the Lithosol and alluvial great soil groups. The classification of the soil series in higher categories and some of the factors that have contributed to their morphology are given in table 10.

TABLE 10.—*Classification of the soil series of Rhea County, Tenn., into higher categories, and some of morphology*

Order	Great soil group	Soil series	Parent material	Relief
			Residuum from the weathering of—	
		Talbott	Moderately clayey limestone	Undulating to rolling
		Dewey	High-grade dolomitic limestone	do
		Fullerton	Moderately cherty dolomitic limestone	Rolling to hilly
		Hanceville	Acid sandstone	Rolling
			General alluvium mainly from—	
		Cumberland	Limestone	Undulating to sloping
		Etowah	do	do
	Red Podzolic soils	Waynesboro	Sandstone, shale, and limestone	do
		Nolichucky	Sandstone and shale	Undulating to strongly sloping
		Sequatchie	Sandstone and limestone	Undulating
			Colluvium and local alluvium mainly from—	
		Allen	Sandstone and Hanceville, Hector, Hartsells, and Muskingum soils	Undulating to sloping
		Emory	Dewey, Cumberland, and Fullerton soils	Gently sloping to sloping
Zonal	Lithosolic	Upshur	Residuum from the weathering of purplish calcareous shale	Rolling to hilly
			Residuum from the weathering of—	
		Clarksville	Highly cherty dolomitic limestone	Rolling to steep
		Apison	Acid sandy shale	Undulating to rolling
		Hartsells	Acid sandstone	do
		Crossville	do	do
	Yellow Podzolic soils	Holston	General alluvium mainly from sandstone and shale	Gently sloping
			Colluvium and local alluvium mainly from—	
		Jefferson	Sandstone and Hartsells and Muskingum soils	Gently sloping to sloping
		Greendale	Fullerton and Clarksville soils	do
			Residuum from the weathering of—	
	Lithosolic	Colbert	Highly clayey limestone	Undulating to rolling
		Conasauga	Interbedded calcareous shale and limestone	do

Intrazonal	Planosols	Wolftever	General alluvium mainly from limestone	Undulating
		Taft	do	Nearly level
		Robertsville	do	do
		Guthrie	Local alluvium and residuum from limestone.	do
	Half Bog soils	Burgin	Local alluvium mainly from Colbert soils	do
Azonal	Alluvial soils	Huntington	General alluvium mainly from— Limestone	do
		Lindside	do	do
		Egam	do	do
		Roane	Cherty dolomitic limestone	do
		Staser	Limestone, sandstone, and shale	do
		Pope	Sandstone and shale	do
		Philo	do	do
		Abernathy	Local alluvium mainly from Dewey, Cumberland, and Fullerton soils.	do
		Ooltewah	do	do
	With glei horizons	Melvin	General alluvium mainly from— Limestone	do
		Dunning	do	do
		Atkins	Sandstone and shale	do
	Lithosols	Montevallo	Residuum from the weathering of— Acid shale	Hilly to steep
		Muskingum	Acid sandstone	do
		Hector	Acid sandstone (reddish colored)	do

[1] Age here refers to the degree to which the soil had developed properties characteristic of a mature soil in equilibrium with a s
A very young soil has few or none of the characteristics of a mature soil, a young soil has these characteristics weakly or moderate
oped, and a very old soil has them developed to a degree greater than that common for mature soils of the region.

RED PODZOLIC SOILS

Red Podzolic soils are a zonal group having thin organic and organic-mineral layers over a yellowish-brown leached layer that rests on an illuvial red horizon and is developed under a deciduous or mixed forest in a warm-temperate moist climate (*9*). The soil-forming processes involved in their development are laterization and podzolization (*6*). These soils have the common characteristics of Red Podzolic soils, and apparently all have developed under relatively similar conditions of climate and vegetation. They are well drained, and, although they range somewhat in degree of maturity, all are sufficiently old to have at least a moderately well-developed Red Podzolic soil profile. They range from level to steep, but differences in profile are probably not due primarily to differences in slope gradient. There are marked differences in parent material among the various soils, and many of these can be correlated with differences in the soil profiles.

TALBOTT SERIES

Talbott soils are characterized by heavy-textured B and C horizons, a characteristic that is associated with the argillaceous limestone from which their parent materials are derived. They are relatively thin over bedrock, and their position, relief, and thickness suggest that the parent limestone weathers rapidly and leaves a relatively small quantity of insoluble residue. They are eroded readily when cultivated and may have been eroded rather rapidly under natural vegetation, which probably accounts in part for their thinness over bedrock. Like the other zonal soils, they have developed under a deciduous forest vegetation and a warm-temperate moist climate. The soils are medium to strongly acid throughout the profile.

The profile description that follows is of Talbott silt loam under a forest mainly of hickory, dogwood, red oak, sassafras, persimmon, and other hardwood trees:

A_0. ½ inch of forest litter.

A_1. 0 to 3 inches, dark-brown weakly granular mellow silt loam, containing many small roots and some white moldlike threads. The material is neutral in reaction.[24]

A_2. 3 to 10 inches, slightly yellowish-gray friable silt loam, becoming slightly sticky in the lower part of the layer. The material is very strongly acid. Many large and small roots are present.

B_1. 10 to 14 inches, light yellowish-red plastic sticky heavy silty clay, hard when dry and cracks into irregular-shaped fragments Some medium and large roots are present The material is strongly acid.

B_2. 14 to 22 inches, light yellowish-red sticky plastic clay or silty clay mottled slightly with yellow and brown. The material is slightly more yellow and more plastic than that of the layer above. It is strongly acid.

B_3. 22 to 33 inches, mottled yellow, red, and brown sticky clay loam, slightly less plastic than the material above. A few soft brown concretions are present. Few roots are in the layer. The material is strongly acid.

C. 30 to 36 inches, mottled brown, yellow, and gray sticky plastic clay that breaks into angular fragments with glossy surfaces. The material is strongly acid. This layer rests on limestone bedrock at 36 inches.

DEWEY SERIES

Dewey soils are developed from the residuum of limestones that are higher in some insoluble materials, particularly silica, than the rocks

[24] Approximate pH of the materials discussed in this section was determined in the field, at the time the soil was described, by the use of several single indicators.

underlying soils of the Talbott series. They are also generally thicker over bedrock and darker red throughout the profile, and have more organic matter in the upper layers, and the texture is generally lighter throughout. They have slightly stronger relief in many places than the Talbott soils, the climate is similar, but the vegetation, especially the ground cover, may have been slightly more dense. It is probable that the major differences in the two series are directly or indirectly the result of differences in parent material.

The following profile description is of Dewey silt loam under a forest of oaks, hickory, dogwood, sweetgum, and other hardwoods that apparently had never been cleared:

A_0. ½ to 1 inch of forest litter.

A_1. 0 to 2 inches, grayish-brown mellow weakly granular silt loam, apparently containing a large quantity of organic matter. The material is neutral to slightly acid.

A_2. 2 to 12 inches, brown friable weakly granular silt loam weakly stained with organic matter and containing numerous small holes. It is strongly acid. Roots are numerous.

A_3. 12 to 18 inches, yellowish-brown friable silt loam containing a few small black concretions. The material breaks into irregular-sized granules. It is very strongly acid.

B_1. 18 to 30 inches, yellowish-brown friable heavy silt loam streaked with dark brown and containing many dark-brown concretions. The material breaks into fragments of irregular size and shape and may be crushed under moderate pressure to a friable mass. It is strongly acid.

B_2. 30 to 40 inches, yellowish-red silty clay loam, compact in place but breaking into small irregular-shaped moderately friable fragments. The material is sticky when wet. It is strongly acid. A few dark-brown concretions and stains are present.

C. 40 inches +, mottled yellow and red silty clay, hard when dry, sticky when wet. Gray, yellow, and brown splotches are present. It is strongly acid.

FULLERTON SERIES

Fullerton soils are developed from material residual from dolomitic limestones high in insoluble materials, particularly silica, which is chiefly in the form of chert. These soils commonly occupy the highest positions; are the deepest, the least fertile, the least erosive, and the most cherty; and have the steepest slopes of all Red Podzolic soils of that part of the Valley and Ridge province in this county. It is significant that these characteristics are associated with a parent material derived from limestone containing the greatest quantity of insoluble material, principally silica, of all of the limestones that give rise to Red Podzolic soils in this county. It is generally true that the quantity of insoluble material in the parent rocks increases from the Talbott through the Dewey to the Fullerton soils. Associated with this increase is generally an increase in chertiness, thickness, and permeability and a decrease in the content of plant nutrients, cohesive properties, and susceptibility to erosion. The colors of the A and B horizons become lighter from the Dewey to the Fullerton soils. Lower susceptibility to erosion and a greater volume of residue from the weathering of rocks apparently result in a thicker mantle of unconsolidated material over bedrock under Fullerton soils than under Talbott or Dewey. This mantle probably protects the bedrock from rapid weathering and may account in part for the higher position on the landscape and the resultant steeper slopes, as compared with Talbott or Dewey soils.

The following profile description is of Fullerton cherty silt loam under a hardwood forest mainly of white, chestnut, post, Spanish, and black oaks, hickory, dogwood, wild cherry, and similar trees:

A_0. About ¾ inch of partly decayed forest litter.

A_1. 0 to 2 inches, dark-brown friable and weakly granular cherty silt loam apparently mixed with organic material from tree leaves, stems, and roots. The layer contains many small live roots and some white moldlike growth. It is medium acid.

A_2. 2 to 16 inches, grayish-brown (gray when dry) cherty silt loam containing brown streaks and stains. The material is slightly sticky when wet but friable when dry. The layer contains many large roots, some dead roots, many root holes and animal burrows, and is medium acid.

B. 16 to 36 inches, yellowish-red cherty silty clay loam that breaks into irregular-shaped small fragments. The material is slightly sticky when wet but brittle when dry. Some yellow streaks and spots are in the soil mass, and a few roots are present. The layer is medium to strongly acid.

C. 36 inches +, yellowish-brown cherty silty clay loam streaked and spotted with yellow, which becomes more yellow and more mottled with depth. The material is brittle, moderately compact in place, sticky when wet, and brittle when dry, and breaks into small angular fragments.

HANCEVILLE SERIES

The Hanceville series consists of undulating to rolling reddish-colored soils developed from gray acid sandstone that weathers to a reddish-colored residue. They are developed from materials residual from a sandstone that is apparently similar to that underlying the Yellow Podzolic Hartsells soils but weathers to a red instead of a yellow residue. The reason for the difference is unknown, but in some places the color may be inherited from that of the parent rock.

The climate is probably slightly cooler than that of the other Red Podzolic soils of this county, but the most striking difference in factors of soil formation between this and the others is in the character of the parent material. There was probably a less dense cover of native vegetation, particularly undergrowth, on the Hanceville soils than on other Red Podzolic soils, but that difference may be attributed largely to differences in soil content of plant nutrients, which are closely related to those of the parent material.

The following profile description is of Hanceville fine sandy loam under a forest that consisted mainly of shortleaf and Virginia pine, hickory, post oak, white oak, dogwood, Spanish oak, and black gum:

A_0. About ½ inch of partly decomposed forest litter.

A_1. 0 to 2 inches, dark grayish-brown fine sandy loam in which are many small roots and numerous small holes. The structure is weakly granular. This layer is brighter yellow in the lower than in the upper part. The material is strongly acid.

A_2. 2 to 10 inches, gray to yellowish-gray friable weakly granular fine sandy loam, becoming more yellowish with depth and containing a few light-gray spots. The material contains many small roots, small insect burrows, and insect larvae and is strongly acid.

A_3 and B_1. 10 to 20 inches, yellowish-red or reddish-yellow fine sandy clay loam, breaking into small irregular-shaped fragments that crush easily to a friable mass, slightly sticky when wet. A few yellow and red splotches are present. The horizon contains many small and large roots, especially in the upper part and is medium acid.

B_2. 20 to 30 inches, brownish-red friable fine sandy clay, slightly sticky when wet but friable to slightly brittle when dry, and breaking into irregular-shaped fragments that crush easily to fine weak granules when dry. The horizon is very uniform in color. A few large roots are present. It is strongly acid.

C_1. 30 to 42 inches, red brittle fine sandy clay with a few sandstone fragments. A few large roots are present. The material is lighter in texture than the layer above and is medium acid.

C_2. 42 to 50 inches, red brittle fine sandy loam containing many weathered yellow sandstone fragments. The material is yellowish red when crushed and becomes more yellowish with depth and more sandy near the bedrock, which underlies this layer.

CUMBERLAND SERIES

The Cumberland soils are well-developed Red Podzolic soils of high terraces and are developed from old alluvium that consists chiefly of materials washed from land underlain by limestone. They have more open and porous substrata and are slightly more friable throughout than in the Dewey series. The relatively high content of bases in the parent material would be expected to retard impoverishment of the alluvial horizon, but the material has been in place long enough to allow development of Red Podzolic soil comparable in maturity with the Dewey soils. The soils are relatively fertile and have good moisture-holding capacity, which probably resulted in heavy vegetative cover and indirectly caused the relatively high content of organic matter in the upper layer. These soils are also similar in many respects to soils of the Decatur series, no members of which were mapped in this county.

The following is a profile description of Cumberland silt loam, but because of its limited acreage it is mapped with Cumberland silty clay loam, eroded phase:

A_p.[25] 0 to 6 inches, dark grayish-brown mellow silt loam containing a moderate quantity of organic matter. A few round pebbles and many small holes and fine roots are present. The material is strongly acid.

A_3 and B_1. 6 to 20 inches, reddish-brown friable silt loam that crushes under moderate pressure to fine irregular-shaped granules Some very fine pores are in the soil mass A few fine dark-colored soft concretions or accretions and round pebbles are present, and roots are numerous in the upper part of the layer but decrease with depth. The material is medium acid.

B_2. 20 to 44 inches, brownish-red friable silty clay loam that crushes easily into fine irregular-shaped granules. A few fine pores are present. The material is slightly more red than the layer above. It contains a small quantity of gravel. This layer is strongly acid.

B_3. 44 to 60 inches, dark yellowish-red slightly sticky silty clay loam containing soft brownish pebbles. Few roots are present. The material is strongly acid.

C. 60 inches +, yellowish-red silty clay loam streaked and faintly spotted with yellow A few weathered pebbles are present. The material is very strongly acid.

ETOWAH SERIES

The Etowah series are moderately well developed Red Podzolic soils of low terraces and are developed from moderately old alluvium washed mainly from soils underlain by limestone. They have relatively open substrata that favor rapid leaching, but the relatively high content of bases in the parent material would be expected to retard impoverishment of the eluvial horizon. The parent materials are similar to those of the Cumberland soils but have been in place for a shorter time. The factor of age is apparently the principal cause of differences between the soils of the two series. In many characteristics,

[25] The symbol A_p is used to designate the upper part of the A horizon mixed or otherwise altered by the activties of man.

particularly color, the more nearly mature Etowah soils resemble Dewey soils, but generally have more friable subsoils.

The profile description that follows is of Etowah silt loam that was under cultivation. The soil had been limed with 2 tons of ground limestone to the acre about 8 years before the profile was described, and applications of manure had been made frequently.

A_p. 0 to 8 inches, grayish-brown to brown mellow silt loam containing a few pieces of gravel. The layer is the plowed part of the soil and is slightly acid to neutral.

A_3 and B_1. 8 to 20 inches, brown friable silt loam with many smaller brown concretions. The material is very slightly sticky when wet and grades gradually into the lower layer. It is strongly acid

B_2. 20 to 36 inches, reddish-brown silty clay loam containing many small soft concretions. The material breaks into fine irregular-shaped fragments when moderately dry, is somewhat compact in place, and is moderately sticky when wet. It is strongly acid.

C. 36 to 64 inches, reddish-brown silty clay slightly lighter in color than the layer above. The material is weakly spotted and streaked with yellow and contains a few fine gravel and chert fragments. It is slightly more sticky when wet and more brittle when dry than in the layer above. This layer is strongly acid.

WAYNESBORO SERIES

The Waynesboro soils are well-developed Red Podzolic soils developed from very old deposits of alluvium that consist mainly of the residue of weathered sandstone and shale and some limestone. They are lacking in the heaviness of texture and consistence of the B horizon common to Red Podzolic soils developed from the residuum of weathered limestone. Their substrata are rather pervious to water and do not retard thorough leaching of the soil mass. Compared with the Cumberland soils, the parent material is low in bases and probably in other elements, and this factor has probably contributed to some of the major differences between the soils of the two series. The characteristics of the parent material would be expected to permit somewhat more rapid development of a mature soil than in the Dewey. Cumberland, or Etowah series. It is probable that the vegetative cover of Waynesboro soils was less luxuriant than in the Cumberland or Etowah soils as a result of a lower nutrient level, and this factor probably contributed to the lighter color of the surface layer.

The following profile description is of Waynesboro fine sandy loam that had been in cultivation for many years:

A_p. 0 to 6 inches (the plowed layer), grayish-brown mellow fine sandy loam containing many fine roots and a few small pores. The material is strongly acid.

A_2. 6 to 14 inches, yellowish-brown friable silt loam that crushes to weak irregular-shaped granules. The material is slightly sticky when wet. This layer contains a few small round pebbles and a few fine pores and roots. It is strongly acid.

B_1. 14 to 24 inches, reddish-brown heavy silt loam or silty clay loam, moderately compact in place. The material breaks into irregular-shaped fragments that crush under moderate pressure to a mass that is slightly sticky when wet. It is strongly acid.

B_2. 24 to 46 inches, red silty clay loam that breaks into irregular-shaped fragments and contains a few small pebbles. The larger fragments have shiny surfaces. Some yellow soft sandstone fragments are present in the lower part. The layer is strongly acid.

C. 46 inches +, red silty clay loam, slightly more friable than the material above. It contains a few yellow streaks and spots that become more numerous with depth, and many soft yellow sandstone pebbles. This layer is strongly acid.

NOLICHUCKY SERIES

The Nolichucky series are developed from parent materials similar to those of the Waynesboro soils, but probably influenced less by limestone. Soils of the two series have apparently been subjected to similar conditions of climate and relief. The Nolichucky soils have a thicker lighter colored A horizon and are generally lower in content of plant nutrients than the Waynesboro. This is an indication of greater age and may be a reflection of more rapid development than in the Waynesboro soils, as a result of a lower base status of the parent material and consequent differences in the quantity of material to be removed and in the kind and density of the vegetation.

The profile description that follows is of Nolichucky fine sandy loam that had been cultivated for a long time. The soil was apparently in a very low state of fertility, and sassafras bushes were the main plants on the idle land where a crop of rye had failed the previous year.

A_1. 0 to 8 inches, gray friable fine sandy loam, light gray when dry and apparently containing very little organic matter, though a few fine roots are present. The material is medium to strongly acid.

A_3. 8 to 11 inches, yellowish-brown fine sandy loam very faintly mottled with brown. The material is slightly more compact than that above and breaks into irregular lumps that crush under moderate pressure to a friable mass. The layer is slightly sticky when wet and is strongly acid.

B_2. 11 to 24 inches, brownish-red friable fine sandy clay that breaks into various-sized nutlike lumps. The material is very uniform in color and is medium to strongly acid. It grades abruptly into the layer below.

C. 24 inches +, mottled red, yellow, and gray brittle fine sandy clay that breaks into small irregularly shaped fragments.

SEQUATCHIE SERIES

The Sequatchie soils are on low-lying terraces that consist of materials washed chiefly from lands underlain by sandstone and shale but show some influence of limestone. They are pervious to water, and the parent material is naturally low in bases. Climate, vegetation, relief, and parent material are similar to those of the smoother phases of the Waynesboro or Nolichucky soils, but the materials have been in place a relatively short time and the soils are relatively young. The profile is that of a weakly developed Red Podzolic soil.

The following profile description is of Sequatchie fine sandy loam that was under cultivation and had been well managed. Lime had been used on the field in recent years.

A. 0 to 12 inches, grayish-brown to brown mellow fine sandy loam, apparently containing considerable organic matter. Roots are numerous. The layer is slightly acid to neutral.

B_2. 12 to 26 inches, faintly reddish-brown fine sandy loam somewhat compact in place and breaking into irregular-shaped fragments that crush to a friable mass under firm pressure. The material contains numerous fine pores. It is strongly acid.

B_3. 26 to 54 inches, reddish-brown fine sandy loam that breaks into firm fragments that when moist crush under moderate pressure to a mellow fine mass. No fine pores are apparent. The layer is less compact than the one above and is very uniform in color. The material is very strongly acid.

C. 54 to 84 inches, light-brown slightly compact friable fine sandy loam to silt loam of uniform color throughout. This layer is less red and less compact than the two layers above and is strongly to very strongly acid.

ALLEN SERIES

The Allen soils have gently sloping to strongly sloping relief and are developed under a deciduous forest and a climate similar to those under which Nolichucky and Waynesboro soils have developed. They are derived from colluvial and local alluvial parent material derived mainly from lands underlain by sandstone or sandstone and shale. The physical condition of the parent material is such that there is free movement of percolating waters, and the base status is sufficiently low to promote rapid development of characteristics of a mature genetic profile. It appears that such materials commonly give rise to Yellow Podzolic soils, or soils such as those of the Jefferson series, in this county. The Allen soils, however, are red, in contrast with the yellow of the Jefferson soils. It is possible that the red color may be inherited from the parent material in some places, particularly where derived from such soils as those of the Hanceville or Hector series; but in most places it appears to have resulted from soil-forming processes. General observation indicates that the Allen soils may have been influenced by material from limestone or other calcareous rocks or by water that carried calcareous materials; and it is possible that this may have been one of the principal factors that led to the development of a Red Podzolic rather than a Yellow Podzolic soil. In many places in the Valley and Ridge province in eastern Tennessee, Allen soils overlie calcareous materials, and it is possible that the influence of water from the underlying material may have been important.

The unit of classification should be distinguished clearly from the unit of mapping in the Allen series. The series as a unit of classification consists of moderately well developed Red Podzolic soils developed from old colluvial materials that were deposited long before the land was cleared and cultivated. In many places these soils are in positions where local wash accumulates at the present time, largely from cultivated fields but in some places from areas undisturbed by man. In many places, as such accumulations cannot be separated on the map from true Allen soils without impractical expenditure of time, they have been included with the mapping units of the Allen series. These inclusions are young azonal soils and therefore are not Allen soils or even Red Podzolic soils. They have been described as inclusions.

The profile description that follows is of Allen very fine sandy loam that had been cropped to lespedeza for 2 or 3 years. Limestone outcrops are near the site of the profile described, and this soil may overlie limestone bedrock at a depth of several feet.

A_p. 0 to 8 inches, brownish-gray mellow fine sandy loam with numerous small sandstone fragments. The material crushes easily to a finely divided mass. It is slightly acid

A_3 and B_1. 8 to 16 inches, brownish-yellow friable very fine sandy loam to very fine sandy clay, slightly sticky when wet but friable when dry. The layer contains a few various-sized sandstone fragments and a few decaying roots, the channels of which are coated with organic matter, and is medium acid.

B_2. 16 to 34 inches, dark yellowish-red brittle but friable very fine sandy clay containing numerous weathered fragments of sandstone and a few of shale The layer is slightly compact but breaks under moderate pressure and is strongly acid.

C. 34 to 48 inches, mottled red, yellow, rust-brown, and gray brittle to friable fine sandy clay. Many soft sandstone and shale fragments are present and contribute to the mottled appearance The layer becomes more yellow and gray with depth and is medium acid.

EMORY SERIES

The Emory soils are developed from local alluvial material washed mainly from adjacent areas of Dewey and Cumberland soils and the redder members of the Fullerton series. They have mild relief, are well drained, and have developed under a deciduous forest and under a climate similar to that under which Etowah soils have developed. Their parent materials are relatively similar to those of the Etowah soils. These soils are generally slightly less well developed Red Podzolic soils than the Etowah, and the degree of profile development is extremely variable from place to place. In many places the unit of mapping includes azonal soils for reasons similar to those described for inclusion in the Allen series. The Emory series as a unit of classification is composed of Red Podzolic soils that are relatively younger than those of the Etowah series.

It should be noted that the Emory soils are mapped over a wide range of latitude in the vicinity of the margin between the Gray-Brown Podzolic and Red Podzolic soil regions. In some places, as in southwestern Virginia, the Emory soils are less red than in Rhea County and are considered to be Gray-Brown Podzolic soils.

The A horizon of the Emory soils is generally dark-brown or dark reddish-brown mellow silt loam 10 to 14 inches thick and appears to contain relatively large quantities of organic matter. The B horizon is generally reddish-brown silty clay loam that crushes easily to a finely divided friable mass. The C horizon is lighter colored than the layers above, is generally mottled, and usually extends below a depth of 2 feet. The soil is commonly medium acid in the B and C horizons.

UPSHUR SERIES

The Upshur soils are developed from the residuum of weathered purplish-red calcareous shale and have rolling relief. The vegetation was chiefly deciduous forest.

There is considerable doubt as to the great soil group to which these soils belong. The reddish color is undoubtedly inherited largely from the parent material. The soil profile is only moderately well developed, and the content of bases is generally higher than in most Red Podzolic soils. They have some characteristics of Brown Forest soils; and some characteristics of Lithosols also. They have been classified tentatively as immature Red Podzolic soils in this section and have been designated as Lithosolic Red Podzolic soils pending accumulation of data that will establish their correct classification.

The profile description that follows is of Upshur silt loam under a virgin forest mainly of hickory, various species of oak, black gum, tuliptree, maple, wild cherry, sourwood, shortleaf and white pines, and dogwood. Apparently fire had not been on this area for many years.

A_0. About ¾ inch of partly decomposed forest litter.

A_1. 0 to 1 inch, dark grayish-brown mellow and friable silt loam apparently with a high content of organic matter. The layer contains many roots and considerable quantities of white moldlike growth and has a sharp transition to the layer below. The material is strongly acid.

A_2. 1 to 8 inches, gray to brownish-gray silty clay loam containing dark-colored streaks that extend from the layer above. The layer contains small roots, some insect larvae, and some fine pores. The material is sticky when wet but friable and weakly granular when dry and is strongly acid.

B_2. 8 to 16 inches, brown to purplish-brown compact silty clay, with a faint suggestion of prismatic structure. The material breaks into nutlike pieces that may be crushed under firm pressure to somewhat sticky crumbs. Many roots are in the upper part of the layer and some large roots are in the lower part. The layer is medium acid.

B_3. 16 to 30 inches, purplish-brown moderately sticky silt loam. This layer is brighter purple, is more sticky and plastic, and has less distinct structural aggregates than in the layer above and grades gradually into the layer below. It is strongly acid.

C_1. 30 to 40 inches, mottled purple, yellow, gray, and brown silty clay, sticky when wet and brittle when dry. Streaks of weathered yellow shale are present The material breaks into angular irregular-sized pieces and is very strongly acid.

C_2 40 to 60 inches, variegated purple, yellow, gray, and rust-brown silty clay to silty clay loam that breaks into irregular-sized and irregular-shaped fragments. Soft purple and yellow weathered shale fragments are in the layer. It is strongly acid.

YELLOW PODZOLIC SOILS

Yellow Podzolic soils are a zonal group having thin organic and organic-mineral layers over a grayish-yellow leached layer that rests on a yellow horizon (*9*). In Rhea County they have undulating to steep relief and were developed under a forest vegetation that consisted mainly of deciduous trees with small admixtures of conifers. There may have been more conifers and a somewhat less luxuriant and different kind of ground cover on the Yellow Podzolic than on the Red Podzolic soils, although the degree of consistency of such a relation is not known. Climatic conditions on the soils of the two groups were apparently similar, with the exception previously noted for the Hartsells and Crossville soils. The parent materials were derived from sandstone, sandstone and shale, shale, highly argillaceous limestone, or highly siliceous limestone.

The causes of development of the pronounced color differences between the Yellow Podzolic and the Red Podzolic soils are not known. It has been noted, however, that Yellow Podzolic soils are generally associated in this county with parent materials either lower in bases or less well drained internally than those of the Red Podzolic group.

CLARKSVILLE SERIES

The Clarksville soils are closely associated geographically with the Fullerton soils, but they are developed from materials residual from the weathering of much more siliceous dolomitic limestone than the underlying Fullerton soils. They developed under a forest that was largely deciduous and are generally less subject to erosion, more cherty, and thicker over bedrock. They complete the chain of zonal soils developed from limestone—the Talbott, Dewey, Fullerton, and Clarksville mentioned in the discussion of the Fullerton series in this section.

It is possible that the parent material of the Clarksville soils may have many of the same effects on the soils that develop from them as have the materials weathered from sandstone. The highly siliceous dolomitic limestone is weathered to great depth, and ap-

parently the residuum has lost most of its bases. The strongly acid reaction and the low base exchange capacity of the residuum indicate that the siliceous part dominates the parent material. The thick covering of saprolite protects the unweathered rock and appears to account in part for the high positions of the Clarksville soils and the resultant steepness of some of the slopes. These soils are not so susceptible to erosion as the other soils developed from limestone residuum, a condition that may be partly responsible for the thickness of weathered material over bedrock.

The profile description that follows is of Clarksville cherty silt loam, undulating phase, in a wooded area. The timber consisted of post, red, black, and blackjack oaks, hickory, and similar hardwood trees.

A_0. ½ inch of partly decayed forest litter.

A_1. 0 to 14 inches, gray cherty silt loam. This layer contains many small roots and grades gradually into the material below. It is friable and medium acid.

A_2. 4 to 12 inches, light yellowish-gray friable cherty silt loam that breaks into weak fragments or poorly defined granules. The material is sticky when wet, contains many roots, especially in the lower part, and grades gradually into the layer below. It is medium acid.

A_3 and B_1. 12 to 20 inches, light brownish-yellow cherty silt loam to cherty silty clay loam. The material is friable when dry but sticky when wet and breaks into small angular fragments. It is strongly acid.

B_2. 20 to 30 inches, brownish-yellow mottled with reddish-brown cherty silty clay loam containing more chert than the layers above. The material breaks into irregular-shaped fragments that may be crushed under firm pressure. This layer grades gradually into the layer below and is very strongly acid.

C. 30 inches +, mottled reddish-brown, yellow, and gray cherty silty clay, more cherty than the layer above. The material is brittle and breaks into various-sized fragments when dry and is moderately sticky when wet. It is strongly acid.

APISON SERIES

Under a climate similar to that of the other zonal soils of the county Apison soils have developed from the residuum of weathered variegated acid shale interbedded with thin layers of sandstone. The vegetation was dominantly deciduous forest, but conifers may have been more abundant than on the Clarksville soils. The relief is undulating to rolling.

Typical Apison soils are relatively thin over bedrock, but they have moderately well developed Yellow Podzolic soil profiles. Weathered shale bedrock is generally between 30 and 40 inches below the surface. The eroded phases have lost a considerable part of the soil in some places, and the soils of the more severely eroded areas are Lithosols of the azonal order.

The profile description that follows is of Apison very fine sandy loam in an area apparently never cleared:

A_0. About ½ inch of partly decayed forest litter.

A_1. 0 to 1 inch, a very dark-brown mixture of very fine sand and organic matter. The material is mellow, weakly granular, and medium acid.

A_2. 1 to 8 inches, faintly yellowish-gray mellow very fine sandy loam that breaks into coarse crumb or weakly granular particles. In the upper part are a few organic fragments and stains and many small roots, and in the lower part some large roots. The material grades gradually into the layer below and is strongly to very strongly acid.

B_2. 8 to 20 inches, yellowish-brown friable very fine sandy clay, slightly compact in place, friable when dry, and sticky when wet. Some large tree roots are in the upper part of the layer. There are a few faintly yellowish and brownish colored streaks and spots. The material is strongly acid.

C_1. 20 to 30 inches, mottled yellowish-brown, yellow, and reddish-brown friable very fine sandy clay containing fragments of weathered shale and sandstone. The material is moderately friable, grades into soft weathered rock in the lower part, and is very strongly acid.

C_2. 30 inches +, mottled yellow, reddish-brown, and gray soft weathered shale interbedded with thin layers of sandstone and grading to unweathered rock. It is very strongly acid.

HARTSELLS SERIES

The Hartsells soils, from the residuum of weathered horizontally bedded sandstone in which are thin lenses of shale, formed under a forest predominantly of oaks and under a climate slightly cooler than that under which soils in the Valley and Ridge province developed. The textural profile is not highly developed, but the soils are sufficiently mature to be considered zonal. It is not known definitely whether they are Yellow Podzolic or Gray-Brown Podzolic soils, but in this county they appear to be Yellow Podzolic. The parent material is low in bases, which may have directly contributed to the development of a Yellow Podzolic soil as well as indirectly through its influence on the kind of vegetation supported. The trees were dominantly oaks, and oak leaves are lower in bases and higher in lignin than are leaves of most other deciduous trees. The soils are strongly to very strongly acid.

The profile description of Hartsells fine sandy loam that follows was made in a cut-over area covered with small hardwood trees, as post, black, and Spanish oaks and hickory and a few shortleaf pines:

A_0. About ½ inch of partly decayed forest litter.

A_1. 0 to 2 inches, grayish-brown loamy fine sand to loamy sand apparently containing a moderate quantity of organic matter. The material is loose when dry and contains few roots. It is strongly acid.

A_2. 2 to 7 inches, light yellowish-brown friable fine sandy loam, slightly sticky when wet. The material breaks easily into fine crumbs or weak granules and contains a moderate quantity of roots of trees and undergrowth. It is strongly to very strongly acid.

B_2. 7 to 15 inches, light yellowish-brown fine sandy clay loam, slightly sticky when wet but friable when moist. The material contains very few roots and is strongly to very strongly acid.

C. 15 to 26 inches, light brownish-yellow fine sandy loam to fine sandy clay loam mottled with yellow, rust-brown, and brown, sticky when wet but friable and crumbly when dry. The layer contains a few small fragments of sandstone, especially in the lower part, and it grades abruptly into bedrock at 26 inches. It is very strongly acid.

CROSSVILLE SERIES

The Crossville soils are browner throughout the profile and are slightly thinner over bedrock than the Hartsells. The parent rocks of the soils of the two series appear to be similar and to consist of level-bedded acid sandstone with some interbedded shales. Crossville soils were developed under vegetation and climate similar to those of the Hartsells soils, but the drainage may be slightly less rapid. Like the Hartsells soils, Crossville soils have some characteristics of Gray-Brown Podzolic soils.

The following profile description of Crossville loam was taken in a forested area on which the trees were dominantly various kinds of oaks, hickory, black gum, and a few shortleaf pines:

A_0. About 1 inch of dark-brown mold from leaves, stems, and roots.

A_2. 0 to 5 inches, brownish-gray mellow loam apparently stained with organic matter and containing many roots and white moldy-appearing spots. It is strongly acid.

A_3. 5 to 12 inches, brown mellow loam, moderately sticky when wet. It contains many large tree roots and many fungus mycelia. The material grades gradually into the underlying layer. It is strongly acid.

B_1. 12 to 18 inches, light-brown or yellowish-brown friable loam that is more firm in place than the material of the layer above. There are faint mottlings of yellow in the lower part of the layer, and a few small sandstone and shale fragments are present.

B_2. 18 to 26 inches, yellowish-brown friable fine sandy clay mottled slightly with yellow and red. The material is moderately compact in place and breaks into small weak fragments. It contains some fragments of weathered sandstone and shale but very few roots. It is strongly acid.

C. 26 to 36 inches, mottled light-brown, yellow, gray, and orange fine sandy clay in which many sandstone and shale fragments are embedded. The material is more compact than the layers above and grades into bedrock at about 36 inches. It is strongly acid.

HOLSTON SERIES

The Holston soils have developed from old alluvium derived chiefly from sandstone and shale. They have gently sloping relief, good external drainage, and adequate but slightly restricted internal drainage. They appear to be the oldest soils, with respect to maturity, of the Yellow Podzolic group, and in some places approach the morphology of Planosols. Like others of the Yellow Podzolic group, they are developed from materials low in bases, a condition that probably promotes rapid soil formation. Slightly restricted internal drainage may also have contributed to the yellow color, which is in contrast with the red of the Nolichucky soils that are well-drained and apparently developed from similar materials.

The following profile description of Holston very fine sandy loam was taken in a forested area on which oaks, hickory, dogwood, wild cherry, black gum, sourwood, shortleaf pine, and white pine were dominant. Many dead trees indicate that the area had been burned over recently.

A_1. 0 to 2 inches, dark grayish-brown mellow fine sandy loam containing fragments and stains of organic litter, with numerous small roots. The layer grades gradually into the horizon below. It is strongly acid.

A_2. 2 to 14 inches, light grayish-yellow friable very fine sandy loam, friable when dry but slightly stickly when wet. Many roots are in the lower part. The soil is medium acid.

B_2. 14 to 30 inches, yellow slightly compact friable very fine sandy clay mottled faintly with spots of grayish brown. It breaks into weak fragments of irregular sizes and shapes. A few roots are present. It is strongly acid.

C. 30 to 56 inches, mottled reddish-brown, brown, yellow, and gray very fine sandy clay, becoming less brown with depth. It is sticky when wet but brittle and friable when dry and breaks into small fragments that may be crushed under moderate pressure. It is strongly acid.

JEFFERSON SERIES

The parent material of the Jefferson soils, like that of the Allen soils, consists of colluvial and local alluvial materials from lands under-

lain by sandstone and shale. It is possible that one of the factors contributing to differences between the two is a slight influence of limestone material or waters from limestone areas in the Allen soils, which is lacking in the Jefferson. Also like the Allen soils, the typical Jefferson soils are zonal, but the mapping unit includes areas of recently deposited alluvium. These included soils are azonal and belong to the alluvial soil great soil group.

The following profile description of Jefferson very fine sandy loam was made in a forested area that appeared to have been cleared at one time but to have been in timber for at least 60 years. The trees are mainly shortleaf pine, various oaks, hickory, persimmon, dogwood, redcedar, and wild cherry, the pine and dogwood dominating.

A_0. About ½ inch of partly decomposed forest litter.

A_1. 0 to 3 inches, dark-brown mellow weakly granular very fine sandy loam, apparently containing a considerable quantity of organic matter and many fine roots. It is medium acid to strongly acid.

A_2. 3 to 14 inches, dark yellowish-brown friable very fine sandy loam containing many roots and some dark stains that extend downward from the layer above. It is medium to strongly acid.

B_1. 14 to 22 inches, yellowish-brown slightly sticky very fine sandy clay loam, friable when dry. Only a few roots are present, mostly in the upper part of the layer. The material is less compact than that of the layer below and the transitions to the adjacent layers are not distinct. It is strongly acid.

B_2. 22 to 32 inches, yellowish-brown slightly compact silty clay loam faintly mottled with dark brown and gray and containing many soft brown concretions. The material is moderately sticky when wet and friable when dry. It is strongly acid.

C. 32 to 40 inches, mottled yellow, gray, and rust-brown silty clay loam to very fine sandy clay loam, becoming grayer with depth. The material is less compact than that of the layer above and is strongly acid.

GREENDALE SERIES

The Greendale soils are developed mainly from local alluvium washed from adjacent areas of Clarksville and the lighter red Fullerton soils. They occupy positions similar to those of the Emory series, but are associated with different soils and are derived from materials lower in bases. They have developed under a climate similar to that under which the Emory soils developed and also under a deciduous forest, but the stands, particularly the undergrowth, may have been less luxuriant. These soils are relatively young, as compared with most of the Yellow Podzolic group, and the degree of development of textural profiles is extremely variable from place to place. The unit of mapping includes many areas of azonal soils of the alluvial soil great soil group. These inclusions consist of recently deposited materials and in most places could not be separated feasibly from the zonal Greendale soils.

The profile description that follows is of Greendale silt loam apparently never cleared. Timber growth includes hickory, post oak, white oak, maple, sourwood, red oak, and other hardwoods.

A_0. About ½ to 1 inch of partly decomposed forest litter.

A_1. 0 to 2 inches, dark-gray mellow and weakly granular silt loam apparently containing a large quantity of organic matter. A moderate number of fine roots are present and a few small fragments of chert. The material is slightly acid.

A_2. 2 to 12 inches, yellowish-gray friable and weakly granular silt loam only slightly sticky when wet and containing roots and a few chert fragments. It is medium acid.

B. 12 to 26 inches, brownish-yellow heavy silt loam or silty clay loam, sticky when wet and becoming hard and brittle when dry. It is slightly mottled with yellow in the lower part, a few roots are in the upper part, and a few fine fragments of chert are present. The material breaks into large irregular-shaped fragments that crush to weak granules under moderate pressure. It is acid in reaction.

C. 26 inches +, mottled yellowish-gray, yellow, and brown silty clay loam, becoming more gray with depth and containing chert fragments throughout the layer. The material is sticky when wet, becomes moderately brittle and hard when dry, and may be crushed to a coarse crumbly structure. It is strongly acid.

COLBERT SERIES

The Colbert soils are heavy, sticky, plastic, and shallow with undulating to rolling relief. They are young Yellow Podzolic soils developed from the residuum of weathered highly argillaceous limestone. The native vegetation was deciduous forest. The extremely heavy textures of the soil layers have retarded the development of a zonal soil. Water percolates through slowly and as a result soil-forming processes take place relatively slowly. The base exchange capacity is greater than in most lighter textured soils, which results in slower impoverishment of mineral materials of the upper part. Although the Colbert soils may be considered zonal, they are on the border line between the zonal and the azonal. The term Lithosolic Yellow Podzolic soils has been used in this report to describe their morphology, which is intermediate between that of the Yellow Podzolic soils and the Lithosols.

The profile description that follows is of Colbert silt loam under a forest that consisted mainly of oaks, hickory, and redcedar:

A_0. About ½ inch of partly decomposed forest litter.

A_1. 0 to 2 inches, brownish-gray mellow silt loam apparently containing a moderate quantity of organic matter and many fine roots. The material is medium acid.

A_2. 2 to 8 inches, yellowish-gray mellow to friable silt loam, faintly mottled with brown and moderately sticky when wet. Many small tree roots are present. It is strongly acid.

B. 8 to 16 inches, mottled yellow, gray, and brown silty clay that breaks into irregular-sized angular fragments and is hard and friable when dry and sticky and plastic when wet. A few tree roots are present. It is strongly acid.

C. 16 to 40 inches, mottled yellow, brown, and gray dense clay containing a few roots. It is very sticky and plastic when wet and hard when dry, and overlies bedrock at 40 inches. It is medium acid.

CONASAUGA SERIES

The Conasauga soils are similar to the Colbert series but are generally less heavy-textured, less sticky, and less plastic. They are developed from calcareous shales interbedded in some places with limestones and were developed under a deciduous forest on undulating to rolling relief. They are relatively subject to erosion, and relatively rapid geological erosion may account partly for their thinness over bedrock. The principal differences between these and the Colbert soils result from differences in parent material. Like the Colbert soils, Conasauga soils are young Yellow Podzolic soils and have been designated in this report as Lithosolic Yellow Podzolic soils to indicate their similarity to Lithosols, which are azonal.

A_0. About ½ inch of partly decomposed forest litter.
A_1. 0 to 6 inches, gray to faintly yellowish-gray mellow silt loam. The material is friable when moist and sticky when wet and grades gradually into the layer below. It is medium acid.
A_2. 6 to 12 inches, pale-yellow to grayish-yellow loam, friable when moist and sticky when wet, and breaking into small irregular-shaped particles. Moderate quantities of tree roots are present. This layer grades gradually into the material below. It is medium acid.
B. 12 to 24 inches, light-yellow slightly compact silty clay, difficultly friable when moist and sticky when wet It breaks into angular fragments of various sizes and shapes. There is slight mottling, and a few flat shale fragments are present in the lower part of the layer. It is medium acid.
C. 24 inches +, mottled pale-yellow, brown, gray, and orange clay to heavy silty clay, hard when dry and sticky and plastic when wet, is mixed with soft shale fragments and grades gradually first into weathered rock and then with depth into solid rock. It is medium acid.

PLANOSOLS

Planosols are an intrazonal group of soils with eluviated surface horizons underlain by B horizons more strongly illuviated, cemented, or compacted than associated normal soils, and developed on a nearly flat upland surface under grass or forest vegetation in a humid or subhumid climate (*9*).

Soils of four series—Wolftever, Taft, Robertsville, and Guthrie—have been designated as Planosols in this report, but some doubt exists as to correctness for the Wolftever and Guthrie soils. The soils of these four series have level or depressional to sloping relief and are imperfectly or poorly drained. All are characterized by a B horizon that is more dense or compacted than in most zonal soils, but its degree of development varies in the four series.

Climatic conditions were similar to those under which the zonal soils developed, but the internal climate is more moist and less well aerated much of the time than in the zonal soils. The kinds of vegetation on the Planosols and on the Red or Yellow Podzolic soils differed somewhat, although deciduous forest was on both. Morphologically, the Planosols appear to be older than the Red or Yellow Podzolics, but the causes of development of morphologically older soils are not known. The relief is such that geological erosion would be slow, but that factor alone would not cause their formation. The material itself is not older in years than that of associated zonal soils of similar relief. It is possible that relatively dense layers in the parent material caused slow internal drainage, which, combined with slow external drainage and unusual siltiness of parent material, resulted in abnormal concentration or cementation of the material in or below the illuvial horizon.

WOLFTEVER SERIES

The Wolftever soils are on low-lying terraces and are derived from alluvium washed mainly from lands underlain by limestone. They have nearly level to sloping relief. External drainage is generally fair, but internal drainage is impeded by a compact layer in the subsoil. Internal drainage is generally adequate for most of the common crops. The Wolftever soils were developed from materials similar to those that give rise to the Etowah soils and apparently also under similar conditions of external climate, vegetation, and relief. As compared with Etowah soils, the internal soil climate is more moist and the soils are less well areated below the A horizon.

The following profile description is of Wolftever silt loam that had been cultivated for many years. The area was in lespedeza at the time the description was made and had been flooded once in the memory of local people.

A_1. 0 to 7 inches, slightly brownish-gray mellow silt loam, having slight horizontal cleavage. This is the plowed layer and contains a few small pebbles and some large gravel. It is medium acid.

A_3 and B_1. 7 to 22 inches, brownish-yellow compact weakly granular silty clay loam, moderately hard when dry and slightly sticky when wet. It contains a few hard concretions and fine specks of mica. It grades gradually into the layer below and is strongly acid.

B_2. 22 to 30 inches, mottled yellow, light-yellow, and dark-brown silty clay loam to silty clay, compact and hard when dry and breaking into angular fragments that crush to a sticky mass when wet. It grades into the layers above and below and is strongly acid.

C. 30 inches +, mottled yellow, light-yellow, gray, and dark-brown compact silty clay, gradually becoming less yellow and more gray with depth. It is sticky when wet and is very strongly acid.

TAFT SERIES

The Taft soils are on level or slightly depressed positions on low terraces and are derived from limestone materials similar to those that give rise to Etowah and Wolftever soils. External climate, general type of vegetative cover, and relief were relatively similar on the three soils, but internal drainage is slower in the Taft soils than in either the other two. The degree of development of a heavy-textured, compact layer in the Taft soils is greater than that in the Wolftever soils, and internal drainage is correspondingly slower.

The following profile description is of Taft silt loam that was in forest but may have been cleared at one time. The trees, which include oaks, maple, black gum, wild cherry, hickory, elm, hackberry, and dogwood, appear to be at least 30 years old.

A_0. About ½ inch of partly decayed forest litter.

A_1. 0 to 2 inches, dark grayish-brown mellow silt loam mixed with leafmold and fine roots. The material is medium acid.

A_2. 2 to 8 inches, yellowish-gray mellow silt loam that crushes to fine weak granules or crumbs. Many large and fine roots and small holes, apparently of worms and dead roots, are in the soil mass. It is medium acid.

B_1. 8 to 20 inches, yellowish-gray silt loam to silty clay loam, sticky when wet and breaking into irregular-sized fragments when dry. It contains a moderate number of tree roots and a few chert fragments and pebbles and is strongly acid.

B_2. 20 to 30 inches, mottled yellow, orange, and gray silty clay loam that breaks into irregular-sized fragments when dry and crushes to a sticky mass when wet. The layer contains very few roots and grades very gradually into the layers above and below and is more compact than either of these layers. It is strongly acid.

C. 30 inches+, mottled gray, rust-brown, yellow, and orange silty clay loam containing fine chert and limestone pebbles and a few pockets of sand. The material is moderately friable and strongly acid.

ROBERTSVILLE SERIES

Robertsville soils, developed from limestone materials similar to those that give rise to Etowah, Wolftever, and Taft soils, occupy nearly level depressions mostly on low or intermediate terraces. External drainage is generally slower than on the Taft soils, the compact layer is more dense, and the A horizon appears to be more highly leached.

The profile description that follows is of Robertsville silt loam in an area that had been cultivated but appeared to have been idle for several years:

- A_s. 0 to 8 inches, gray silty loam to silty clay loam, sticky when wet, and friable when dry. The vegetative cover was very sparse so that very few roots were present. The material is medium to strongly acid.
- B_2 8 to 16 inches, mottled gray, yellow, and rust-brown sticky plastic and highly compact clay loam. This layer appears to be very slowly permeable to water and is more compact, tougher, and grayer than the layer below. It is medium to strongly acid.
- C. 16 to 28 inches, mottled rust-brown, yellow, and gray clay loam, browner but less sticky and plastic than the layer above. It is medium to strongly acid.

GUTHRIE SERIES

The Guthrie soils are in depressions and are developed from local wash from adjacent soils derived from the residuum of weathered limestone. In some places limestone residuum has contributed to the parent material. They have the common characteristics associated with poor drainage and generally have a compact heavy-textured layer in the lower part of the profile. In drainage conditions they are comparable to Robertsville soils.

The following profile description is of Guthrie silt loam in a forested depression in which the trees were mainly hardwoods. In wet seasons, water stands on the soil. Wash from a nearby road may have influenced the acidity of the two upper layers.

- A_0. About ½ inch of partly decayed forest litter.
- A_1 0 to 2 inches, brownish-gray silt loam, friable or mellow when moist and easily crushed into fine soft particles when dry. The layer appears to contain a considerable quantity of organic matter. It is slightly acid.
- A_2. 2 to 7 inches, pale-gray mottled slightly with brown and lighter gray silt loam. The material is smooth and mellow and breaks into nut-sized fragments when moist and into finer particles when dry. Many large and fine roots are present It is slightly acid.
- B. 7 to 20 inches, gray mottled with rust-brown and light-gray smooth silty clay loam. The material breaks into hard nutlike fragments that appear lighter gray when dry and the surface of which is shiny when moist. Very few roots are present. This layer is strongly acid.
- C. 20 inches +, gray mottled with rust-brown and olive-drab silty clay or clay. The layer is slightly less gray than the layer above and the material breaks into slightly larger and more angular fragments. Very few roots are present. The material is very strongly acid.

HALF BOG SOILS

Half Bog soils are an intrazonal group with mucky or peaty surface soils underlain by gray mineral soils and developed largely under swamp-forest types of vegetation, mostly in humid or subhumid climate (*9*). In these the principal soil-forming process is gleization: They are formed under conditions such that there is an excess of water in the soil much of the time. Aeration is poor, and as the organic matter does not decay so fast as on better drained soil, it accumulates in the surface layer. The lower part of the soil is subjected to reducing conditions most of the time, and as a consequence the color of the subsoil is gray or blue.

BURGIN SERIES

Burgin clay loam is the only Half Bog soil mapped in the county. It is poorly drained and is developed from local alluvial materials washed from soils underlain by limestone, mostly from Colbert or

other heavy-textured soils. It occupies depressions in which water accumulates on nearly level or gently sloping areas that are affected by seepage from higher lying lands. The mucky or peaty layer and the glei layer are not so well developed in most places as in typical Half Bog soils, but the concentration of organic matter is relatively high and the soil resembles Half Bog more than soils of any other great soil group.

In forested areas there is a thin layer of partly decomposed forest litter. The A_1 horizon is generally very dark brownish-gray to black slightly alkaline clay loam about 10 to 15 inches thick. The upper part of this layer has a granular or crumb structure, and the lower part breaks into angular fragments about one-fourth inch in diameter. The underlying glei horizon is generally medium-gray sticky and plastic clay, mottled with yellow and is about neutral in reaction. It is underlain by similar material but with much brown mottling and is calcareous in places. Some areas of Burgin clay loam do not have a distinct glei horizon and in such places the material of the corresponding layer is generally yellow mottled with gray and brown.

ALLUVIAL SOILS

Alluvial soils are an azonal group developed from transported and relatively recently deposited material (alluvium) characterized by a weak modification (or none) of the original material by soil-forming processes (*9*). In Rhea County these soils are on first bottoms along streams and in depressions in the uplands. They have nearly level to depressional relief and medium to very slow internal drainage. Their main characteristic in common is lack of a soil profile in which the horizons are genetically related. The characteristics of the soils are closely related to the character of the alluvial deposit.

Alluvial soils derived from similar parent materials may differ in the condition of drainage, and this produces some differences in their characteristics. Such soils have been differentiated mainly on the basis of characteristics associated with good, imperfect, or poor drainage and collectively they constitute a soil catena. In order to bring out the relations among the alluvial soils, they are discussed in relation to their positions in soil catenas.

HUNTINGTON, LINDSIDE, AND MELVIN SERIES

The Huntington, Lindside, and Melvin series constitute a catena of soils derived from general alluvium consisting mainly of weathered limestone materials. They are neutral or slightly acid. Huntington soils are well drained; Lindside imperfectly drained; and Melvin poorly drained. The Huntington soils are brown or dark brown to depths of 20 or 30 inches; the Lindside are brown to depths between 12 and 18 inches, below which they are mottled gray, yellow, and brown; and the Melvin soils are mottled gray, yellow, and brown from the surface downward. Textures range widely among the various types of each series and from place to place in the lower layers of the same type. In general, textures of the lower layers of the Melvin soils are heavier than those of the Huntington soils. Textures of the lower layers of the Lindside soils are generally intermediate between those of the Huntington and the Melvin. These differences are

thought to be mainly accidents of deposition that, with differences in height of water table, have contributed to differences in drainage. There is some indication that the heavier textures of the lower layers of the Melvin soils may be partly the result of soil-forming processes, and the lower layers have some of the characteristics of the glei horizons of Half Bog soils. For this reason, the Melvin soils are here designated as alluvial soils with glei horizons.

EGAM SERIES

The Egam soils are closely related to those of the Huntington series. They are derived from similar kinds of material but at a depth of about 15 or 20 inches are characterized by a layer that is more heavy textured and compact than corresponding layers of Huntington soils. Whether they are older morphologically or result from particular periods of deposition of coarse and fine materials is unknown. In many places the compact layer is dark and suggests an old surface layer buried under more recent alluvium. The upper 15 inches is generally brown mellow silt loam or silty clay loam. Underlying this is a layer of dark-brown compact silty clay about 10 inches thick, generally lighter in texture and less compact than the material above, and mottled with yellow and brown, slightly so in the upper part and more with increasing depth. The soil is neutral or slightly acid throughout. Inasmuch as it is subject to flooding and commonly receives new deposits of alluvial material, it would appear that the heavy layer is not entirely the result of illuviation from layers above it. Therefore it has been placed in the alluvial soil great soil group.

DUNNING SERIES

Soils of the Dunning series are derived from heavy-textured alluvium washed mainly from soils underlain by limestone and differ from Melvin soils principally in being heavier textured. They are young soils and are slightly alkaline to slightly acid throughout the profile. The upper layer is stained dark with organic matter to a depth of 15 or 20 inches, below which is mottled brown, yellow, and gray clay or silty clay. Like the Melvin soils, they have some characteristics of Half Bog soils and are here designated as alluvial soils with glei horizons.

ROANE SERIES

Roane soils are unusual in having a tightly embedded or weakly cemented layer of chert at a depth of 10 to 30 inches. They are young soils, and the alluvial material that gives rise to them has been washed mainly from cherty Clarksville and Fullerton soils of the adjacent uplands.

The following profile description is of Roane cherty silt loam in a cultivated field that had probably been limed within recent years.

A_1. 0 to 12 inches, grayish-brown to yellowish-brown loose, mellow, and slightly acid cherty silt loam.

C_1. 12 to 26 inches, tightly embedded fine chert in a matrix of grayish-brown silt loam soil material. The chert fragments can be broken apart when the soil is moist, but the layer appears to be weakly cemented when dry. The layer is imperfectly stratified. The material is medium to strongly acid.

C_2. 26 inches +, gray to bluish-gray sticky cherty silt loam. The soil material appears to contain some sand and is hard when dry and sticky when wet. It is medium acid.

STASER SERIES

Staser soils are alluvial soils derived from materials washed mainly from lands underlain by sandstone and shale but with a strong influence of calcareous materials. They differ from the Pope soils mainly in that they are slightly acid or neutral instead of strongly acid, and from the Huntington soils in being lighter colored and generally less fertile. These differences are closely related to differences of the parent materials.

The upper 6 to 10 inches is brown or grayish-brown sandy material, neutral or slightly acid, and this grades to light-brown or light grayish-brown sandy material that is neutral or slightly acid and is commonly mottled with gray, yellow, and brown below a depth of 20 inches. In some places the second layer is darker than the upper layer.

POPE, PHILO, AND ATKINS SERIES

Pope, Philo, and Atkins soils are well drained, imperfectly drained, and poorly drained members, respectively, of a catena whose parent materials are recent general alluvium washed mainly from lands underlain by acid sandstone and shale. Pope, Philo, and Atkins soils are comparable in condition of drainage and associated characteristics with the Huntington, Lindside, and Melvin soils, respectively, but they differ in characteristics that result from their being derived from acid shale and sandstone rather than from limestone materials. The soils of the Pope catena are generally lighter colored and much more strongly acid than those of the Huntington catena.

Pope soils are light brown to a depth of 30 inches or more. The color commonly becomes slightly lighter with depth, and the soil may be mottled with yellow and gray below 30 or 40 inches. The upper layer of Philo soils is similar, but is highly mottled with gray, yellow, and brown below a depth of 12 to 20 inches. The Atkins soils are mottled gray and yellowish brown from the surface downward, and the deeper layers may be dominantly bluish gray. Textures are commonly lighter than in the Huntington catena, but they may range widely from place to place and from layer to layer in the lower parts of the profile. The Atkins soils are commonly heavier textured in the lower parts of the profile than Pope soils, and like the Melvin and Dunning they have developed some characteristics of a glei layer in the lower part of the profile. In this report they are designated as alluvial soils with glei horizons.

ABERNATHY AND OOLTEWAH SERIES

Abernathy and Ooltewah soils are well drained and imperfectly drained members, respectively, of a catena whose soils are derived from local alluvium washed mainly from soils underlain by limestone. Though somewhat comparable to Huntington and Lindside soils, respectively, they are derived from local rather than general alluvium, but commonly are not underlain by strata of sand and gravel and are generally slightly more acid. External drainage is poor on both the

Abernathy and Ooltewah soils and most of the drainage is internal through cracks and crevices in the underlying limestone bedrock. Internal drainage is rapid to medium rapid through the Abernathy soils, but it is slightly impeded through the Ooltewah soils.

Abernathy silt loam is a young soil, brown to dark brown and mellow to a depth of 30 inches or more, and generally slightly to medium acid. Ooltewah silt loam is generally grayish brown and mellow to a depth between 8 and 16 inches, below which it is brownish gray mottled with gray, brown, and yellow, and is generally slightly or medium acid. There are considerable variations in these soils from place to place as a result of differences in quantity of recent deposition.

LITHOSOLS

Lithosols are an azonal group of soils having no clearly expressed soil morphology, consisting of a freshly and imperfectly weathered mass of rock fragments, and largely confined to steeply sloping land (*9*). The positions occupied are such that geological erosion is relatively rapid. The soils generally consist of rather easily eroded materials. As a result, material is removed from the surface and so mixed as not to have been acted upon for a sufficient length of time by soil-forming processes to produce well-defined genetic soil characteristics. As mapped, these soils include small areas of zonal soils. Two land types in the county are man-made Lithosols, consisting of rough gullied land in which the true soil has been lost from most of the area by accelerated erosion induced by man s activities.

MONTEVALLO SERIES

Montevallo soils are hilly to steep soils that consist mainly of easily eroded, weathered acid shale, on the steep slopes of which geological erosion removes the upper layer almost as fast as it is formed. In some places the material has been in place a sufficient time for the development of a young Yellow Podzolic soil, and such areas are mapped with units of the Montevallo soils as inclusions. In most forested areas there is a thin layer of organic debris (A_0) and about 2 inches of A_1 horizon over about 5 inches of yellowish-gray silt loam A_2 horizon. This material rests on weathered shale in some places; in others it is underlain by as much as 15 inches of brownish-yellow firm silty clay loam, which rests on weathered shale.

MUSKINGUM SERIES

Muskingum soils are shallow azonal soils derived from the residuum of weathered acid sandstone interbedded in some places with thin layers of shale and showing little evidence of a genetic morphology. The steep relief favors geologic erosion and the parent rock is resistant to weathering. In most places the AC soils have a thin layer of forest litter (A_0) on the surface; 1 or 2 inches of A_1 horizon, or organic-mineral layer; and from 9 to 20 inches of yellow to brownish-yellow fine sandy loam that overlies unweathered sandstone. A few small areas of Yellow Podzolic soils similar to those of the Hartsells series are included in the unit of mapping.

HECTOR SERIES

Hector soils occupy positions and are subjected to an environment similar to those of the Muskingum soils, but differ mainly in that the thin mineral soil layer over the sandstone bedrock is reddish brown to red instead of yellow. The color is inherited from the parent rock.

LAND TYPES

Rough gullied land (limestone residuum), rough gullied land (Apison and Conasauga soil materials), rough stony land (Muskingum soil material), rolling stony land (Colbert soil material), limestone outcrop, and stony colluvium (Muskingum soil material) are types of land on which no true soil exists in most places. The two types of gullied land are the result of man-induced accelerated erosion on the indicated kinds of soils. The rough stony land, rolling stony land, and limestone outcrop types are mainly the result of geologic erosion keeping pace with the rate of weathering. Stony colluvium is a mass of unweathered sandstone fragments in a matrix of Muskingum soil material. Mines, pits, and dumps are also present in the county.

LITERATURE CITED

(1) CAMPBELL, T. J.
1940. RECORDS OF RHEA. 204 pp., illus. Dayton, Tenn.

(2) FENNEMAN, N. M.
1938. PHYSIOGRAPHY OF EASTERN UNITED STATES. 714 pp., illus. New York and London.

(3) GOODSPEED PUBLISHING COMPANY.
1887. HISTORY OF TENNESSEE FROM THE EARLIEST TIMES TO THE PRESENT; TOGETHER WITH A HISTORIC AND BIOGRAPHIC SKETCH OF FROM TWENTY-FIVE TO THIRTY COUNTIES OF EAST TENNESSEE. THE EAST TENNESSEE EDITION. 1,317 p., illus. Chicago and Nashville.

(4) HALL, R. C.
1910. PRELIMINARY STUDY OF FOREST CONDITIONS IN TENNESSEE. Tenn. Geol. Survey Bul. 10, 56 pp., illus.

(5) KELLOGG, C. E.
1937. SOIL SURVEY MANUAL. U. S. Dept. Agr. Misc. Pub. 274, 136 pp., illus.

(6) MARBUT, C. F.
1935. SOILS OF THE UNITED STATES. U. S. Dept. Agr. Atlas of Amer. Agr., pt. 3 (Adv. Sheets 8), 98 pp., illus.

(7) MOON, J. W., HIGBEE, H. W., ROBERTS, W., and others.
1941. SOIL SURVEY OF JEFFERSON COUNTY, TENNESSEE. U. S. Dept. Agr., Bur. Plant Indus. Soil Survey Rpt., Ser. 1935, No. 20, 104 pp., illus.

(8) PEACOCK, N. D.
1939. THE RELATIVE IMPORTANCE OF VARIOUS FACTORS INFLUENCING PROFITS IN STRAWBERRY PRODUCTION. Mich. Agr. Expt. Sta. Tech. Bul. 162, 75 pp.

(9) UNITED STATES DEPARTMENT OF AGRICULTURE.
1938. SOILS AND MEN. U. S. Dept. Agr. Yearbook (Soils and Men) 1938: 1232 pp., illus.

(10) UNITED STATES GEOLOGICAL SURVEY.
1895. GEOLOGIC ATLAS OF THE UNITED STATES, PIKEVILLE FOLIO, TENNESSEE. U. S. Geol. Survey, folio 21, [12] pp., illus.

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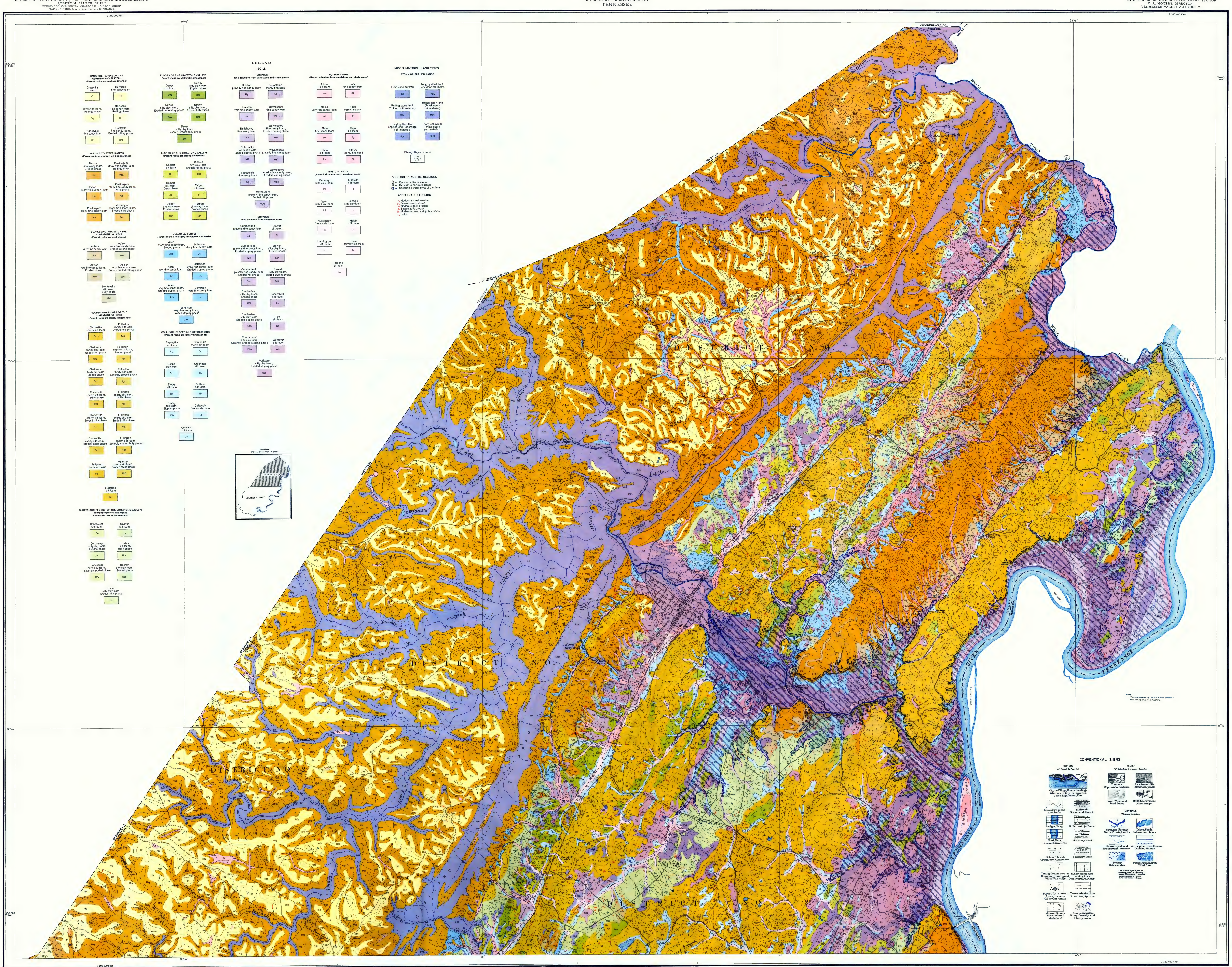
ROBERT M. SALTER, CHIEF
DIVISION OF SOIL SURVEY, CHARLES E. KELLOGG, CHIEF
MAP DRAFTING, J. W. McKERICHER, IN CHARGE

SOIL MAP

RHEA COUNTY—NORTHERN SHEET
TENNESSEE

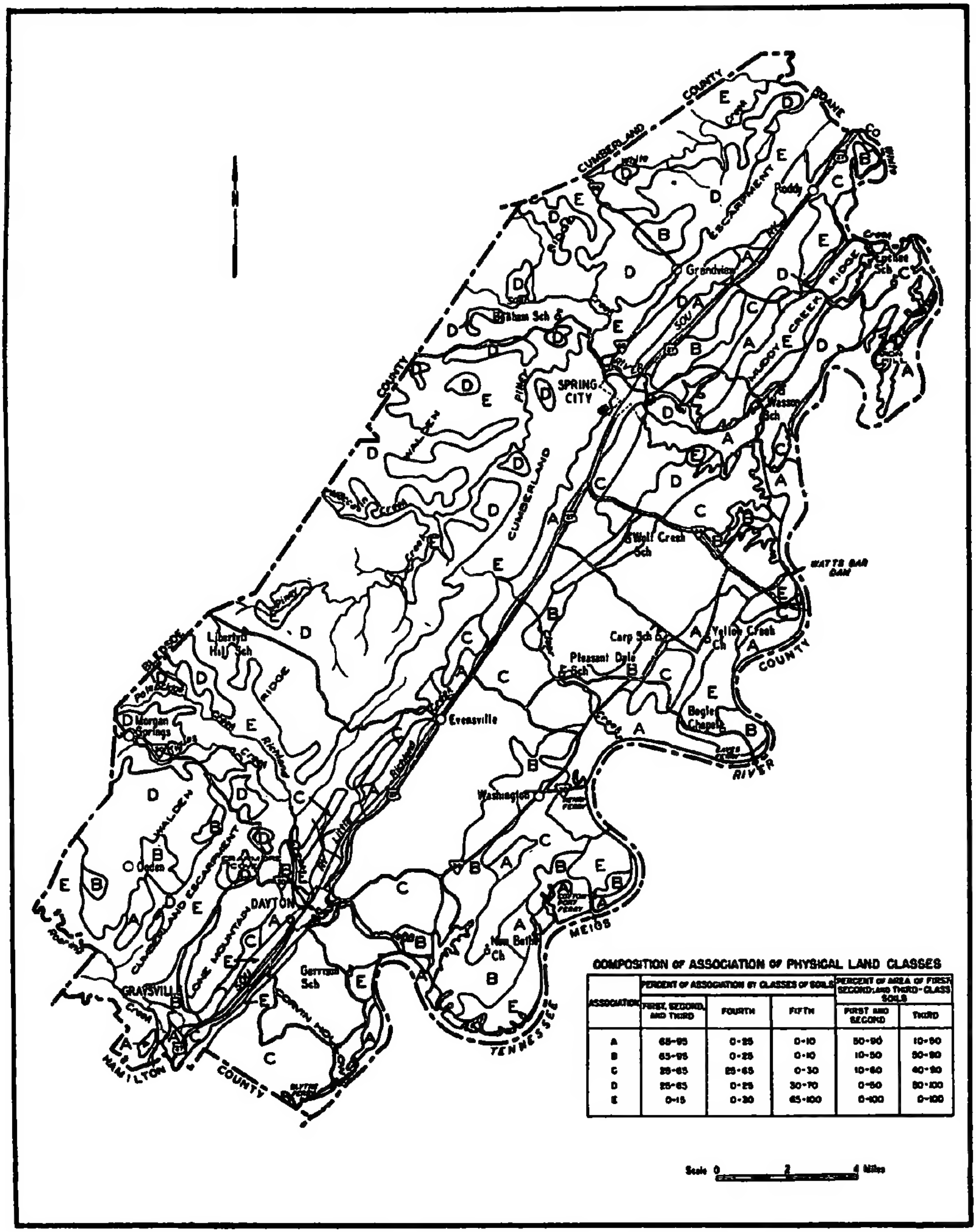
TENNESSEE AGRICULTURAL EXPERIMENT STATION
C. A. MOOERS, DIRECTOR
TENNESSEE VALLEY AUTHORITY



Lith. A. Hoen & Co. Inc.

Area inspected by J. W. Moon, Principal Soil Scientist.
Soils surveyed by A. H. Hasty, in charge, C. A. Mogen and C. B. Beadles, U. S. Department of Agriculture, and W. C. Sams and James Tyer, Tennessee Agriculture Experiment Station.

Polyconic projection, 1927 North American datum.
Base map in part from T. V. A. Planimetric Maps.
10000 foot grid based upon Tennessee system of plane coordinates
Surveyed in 1938-40. Series 1940.



ASSOCIATION	PERCENT OF ASSOCIATION BY CLASSES OF SOILS			PERCENT OF AREA OF FIRST, SECOND, AND THIRD-CLASS SOILS	
	FIRST, SECOND, AND THIRD	FOURTH	FIFTH	FIRST AND SECOND	THIRD
A	65-95	0-25	0-10	50-90	10-50
B	65-95	0-25	0-10	10-50	50-90
C	35-65	35-65	0-30	10-60	40-90
D	25-65	0-25	30-70	0-50	50-100
E	0-15	0-30	65-100	0-100	0-100

Figure 18.—Areas of five associations of physical land classes of Rhea County, Tenn.

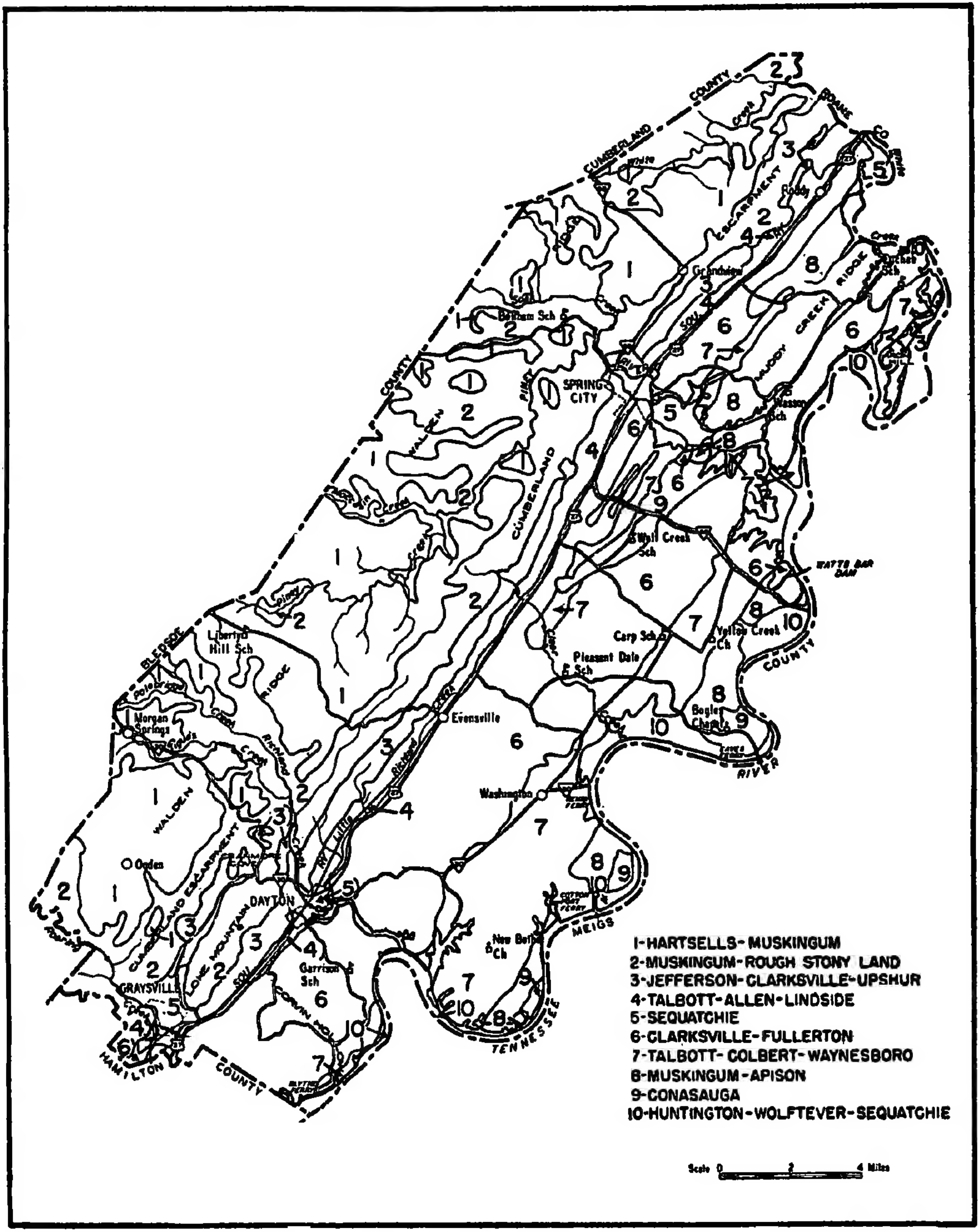


Figure 4.—Soil associations of Rhea County, Tenn.

545846—48 (Face p. 36)

TABLE 4.—*Characteristics of the soil series of Rhea County, Tenn.*

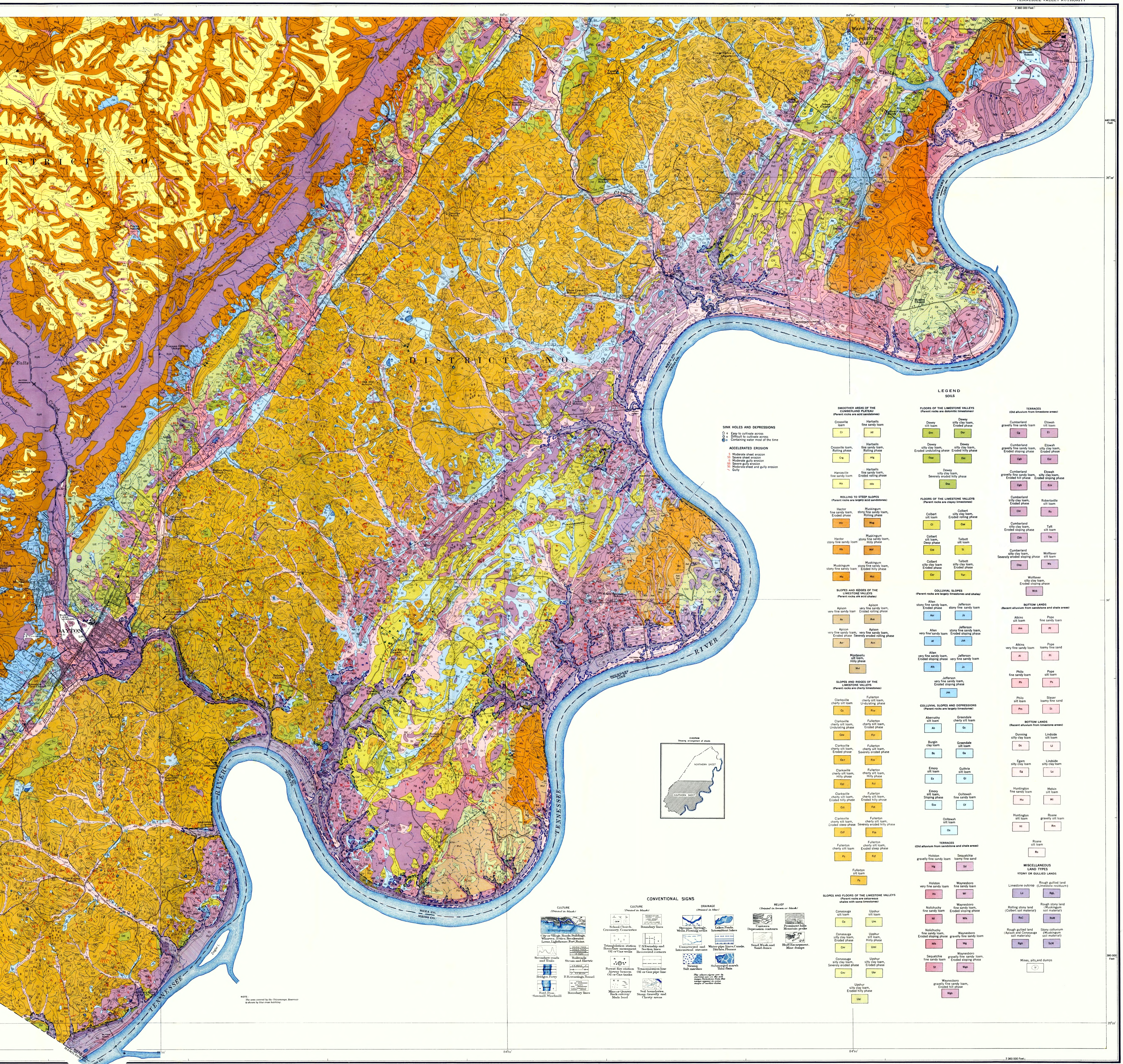
Soil series	Topographic position	Parent material	Dominant relief	Drainage		Surface soil[1]		Subsoil[2]		Remarks
				External	Internal	Color, consistence, and texture	Approximate thickness	Color, consistence, and texture	Approximate thickness	
UPLANDS										
		Material residual from weathering of—					*Inches*		*Inches*	
Colbert	Valleys	Highly clayey limestone.	Undulating to rolling.	Medium	Very slow	Brownish-gray to grayish-brown friable silt loam to silty clay loam.	4 to 8	Yellow mottled with gray tough tenacious silty clay.	15	Shallow over bedrock. Limestone outcrops common. Low in productivity, of unfavorable tilth. Difficult to work. Locally called waxy land. Bedrock at 20 inches.
Talbott	do	Moderately clayey limestone.	do	Medium to rapid.	Medium to slow.	Grayish-brown to brownish-gray friable silt loam to silty clay loam.	5 to 8	Yellow-red to light-red compact sticky plastic silty clay.	18 to 30	Medium in productivity. Suited to general farm crops where slope is favorable. Occasional limestone outcrops. Highly susceptible to erosion.
Dewey	do	High-grade dolomitic limestone.[3]	do	do	Medium	Grayish-brown mellow silt loam	10	Red to brownish-red firm but friable silty clay.	50	Of high productivity. Well suited to general farm crops on milder slopes; to pasture on stronger slopes. Bedrock at 5 to 30 feet.
Fullerton	Strongly rolling ridges and slopes.	Moderately cherty dolomitic ridges.	Rolling to hilly	Rapid	do	Brownish-gray friable silt loam or cherty silt loam.	10	Yellowish-red to light-red firm but friable silty clay loam to silty clay.	40	Generally cherty. Medium in productivity. Responsive to fertilization. Well suited to general field crops, fruits, vegetables on mild slopes. Bedrock at 5 to 30 feet.
Clarksville	do	Highly cherty dolomitic limestone.	Rolling to steep	Rapid to very rapid.	Rapid	Gray friable cherty silt loam	8	Yellow friable cherty silty clay loam.	30	Locally referred to as white gravelly land. Very cherty. Low in productivity. Poorly suited to field crops but fairly well suited to strawberries and peaches. Bedrock at 10 to 30 feet.
Upshur	Moderate to strong slopes.	Purplish calcareous shale.	Rolling to hilly	Rapid	Medium	Purplish-brown friable silt loam	8	Dull-red firm moderately plastic silty clay.	10	Of moderately high natural productivity but easily damaged by runoff water. Much of the cleared acreage has been eroded materially. Bedrock at 2 to 4 feet.
Conasauga	Valleys	Calcareous shale interbedded with some limestone.	Undulating to rolling.	Medium	Very slow	Brownish-gray to grayish-brown friable silt loam or silty clay loam.	4 to 8	Yellow mottled with gray tough tenacious silty clay.	15	Low in productivity; of unfavorable tilth. Difficult to work. Easily damaged by runoff water. Bedrock at 20 inches.
Montevallo	Strongly rolling to steep ridges and slopes.	Acid shale	Hilly to steep	Rapid	Medium	Variable thickness over bedrock, but commonly less than 15 inches thick. Areas of thicker soil have thin yellowish-gray silt loam surface soils and about 10 inches of brownish-yellow silty clay loam subsoils over weathered shale.				Low in productivity. Easily damaged by runoff water. Best suited to forest. Commonly very shallow over weathered acid shale but variable in thickness.
Apison	Valleys	Acid sandy shale	Undulating to rolling.	Medium	do	Yellowish-gray friable very fine sandy loam.	6 to 8	Brownish-yellow firm but friable sandy clay loam.	12	Easily worked but low in productivity. Easily damaged by runoff water. A great part of the acreage damaged by erosion. Bedrock at 30 inches.
Hector	Steep slopes of lower part of Cumberland escarpment.	Acid sandstone	Hilly to steep	Very rapid	do	Variable thickness over bedrock, but mostly less than 12 inches thick. Areas of thicker soil have grayish-brown to brown fine sandy loam surface soil and red fine sandy loam subsoil.				Of moderate fertility. Easily damaged by runoff. Not well suited to tillage.
Muskingum	Steep long slopes of the Cumberland Plateau.	do	Hilly to very steep	do	Medium to rapid.	Variable as to depth but for the most part shallow to bedrock, steep and stony. Thicker parts have grayish-brown loose fine sandy loam surface soil and yellowish friable fine sandy clay loam subsoil.				Low in fertility; of low moisture-holding capacity. Not well suited to either tillage or pasture.
Hartsells	Smooth ridge tops of the Cumberland Plateau.	do	Undulating to rolling.	Medium	do	Brownish-gray to yellowish-gray loose fine sandy loam.	8	Yellow to brownish-yellow friable sandy clay loam.	20	Low in natural fertility, somewhat droughty, easily worked. Bedrock at 40 inches. Responsive to proper management. Particularly suited to certain truck crops such as potatoes.
Crossville	do	Acid sandstone with some thin shale beds.	do	do	Medium	Grayish-brown friable fine sandy loam to loam.	10	Yellowish-brown friable loam to clay loam.	20	Similar to Hartsells in crop suitability and yields, but is somewhat shallower to bedrock. Bedrock at 24 to 30 inches.
Hanceville	Rolling areas on the ridges adjacent to the steep escarpment slopes.	Acid sandstone	Rolling	Rapid	Medium to rapid.	Yellowish-gray to grayish-brown loose fine sandy loam.	10	Reddish-yellow friable sandy clay loam.	20	Limited acreage. Easily worked. Responsive to good management. Bedrock at 30 to 50 inches.
COLLUVIAL LANDS										
		Colluvium and local wash from—								
Allen	Footslopes especially along base of Cumberland escarpment.	Sandstone outcrops, Hanceville, Hector, Hartsells, and Muskingum soils.	Undulating to sloping.	Medium to rapid.	Medium	Grayish-brown friable very fine sandy loam.	8	Red firm but friable sandy clay	30	Productive, easily worked, suited to most crops commonly grown.
Jefferson	do	Sandstone outcrops, Hartsells and Muskingum soils.	Nearly level to sloping.	do	Rapid	Grayish-brown to brownish-gray loose fine sandy loam to stony loamy fine sand.	8 to 14	Brownish-yellow friable clay loam to loam.	20	Low in productivity; easily worked except where stony.
Emory	Gentle foot slopes and drainways.	Dewey, Cumberland, and higher grade Fullerton soils.	Gently sloping to sloping.	do	Medium	Brown friable silt loam	10 to 14	Reddish-brown to yellowish-brown friable silty clay loam	24	One of the most productive soils of the county Practically all tilled.
Greendale	do	Fullerton and Clarksville soils.	do	do	Medium to slow.	Yellowish-gray friable silt loam to cherty silt loam.	10	Brownish-yellow firm but friable cherty clay loam.	20	Important as cropland, especially where associated with Clarksville soils. Moderately productive and has a fairly wide suitability. Much of it is used for corn, forage, and truck crops.
Burgin	do	Colbert soils	Nearly level to very gently sloping.	Medium to slow.	Slow	Dark-brown plastic silty clay loam.	10	Mottled bluish-gray and yellow plastic clay.	14 to 50	Fertile, but drainage and consistence limit its suitability for crops requiring tillage. Good pasture except during dry periods. Bedrock at 2 to 5 feet.
Abernathy	Depressions	Dewey, Cumberland, and higher-grade Fullerton soils.	Nearly level (depressional).	Very slow	Medium to rapid.	Young soil. Generally brown friable silt loam to a depth of 30 inches, below which the material is faintly mottled with gray and yellow.				Very productive, easily worked. Suited to intensive use.
Ooltewah	do	Materials derived from limestone, chiefly higher grades of limestone.	do	do	Slow	Young soil. Generally grayish-brown silt loam to a depth of 8 to 16 inches, below which the material is mottled with gray and yellow.				Very productive, easily worked. Subject to temporary flooding. Suited best to corn and other forage crops.
Guthrie	do	Materials derived from limestone.	do	do	Very slow	Gray silt loam surface soil and gray compact clay subsoil, mottled with yellow and brown				Low in natural fertility. Poor drainage limits its suitability chiefly to pasture and meadow.
TERRACES										
		Alluvium comprised chiefly of material derived from—								
Cumberland	Chiefly high terraces	Limestone	Undulating to sloping.	Medium to rapid.	Medium	Brown friable silt loam, gravelly in places.	10	Red to brownish-red firm but friable silty clay.	30	Very productive, suited to a wide variety of crops. Practically all tilled.
Etowah	High and intermediate terraces.	do	do	Medium	do	Grayish-brown friable silt loam	10	Yellowish-brown to reddish-brown firm but friable silty clay loam.	30	Productive, suited to a wide variety of crops. Practically all tilled.
Wolftever	Low terraces	do	Undulating	Slow	Slow	Brownish-gray friable silt loam	7	Yellowish-brown compact silty clay loam.	20	Moderately productive. Fairly easily worked; not very susceptible to erosion hazard. Corn and hay and small grains prevail.
Taft	do	do	Nearly level	Very slow	do	Gray friable silt loam	8	Yellowish-gray firm moderately plastic silty clay loam, with slight mottlings.	30	Moderate fertility and slow drainage limit the productivity and suitability of this soil. Hay crops, pasture, and corn are most common crops grown.
Robertsville	do	do	Nearly level (depressional).	do	Very slow	do	7	Gray mottled with yellow and brown compact silty clay.	20	Of low natural productivity. Best suited to pasture. Limited acreage. Associated with Wolftever especially.
Waynesboro	Chiefly high terraces	Sandstone, shale, and limestone.	Undulating to sloping.	Medium to rapid.	Medium to rapid.	Brown to grayish-brown friable very fine sandy loam.	8	Brownish-red firm but moderately friable clay loam.	30	Productive, easily worked except where gravelly. Well suited to most general farm crops. Practically all tilled.
Nolichucky	do	Sandstone and shale.	Undulating to strongly sloping.	do	do	Gray loose fine sandy loam	8	Reddish-yellow brittle firm sandy clay.	30	Of low natural fertility. Some acreage idle land.
Holston	High and intermediate terraces.	do	Undulating to sloping.	do	Medium	Gray loose fine sandy loam, gravelly in places.	12	Yellow firm but friable sandy clay.	10 to 20	Of low natural fertility. Responds to proper management. Mottled with gray below 30 inches.
Sequatchie	Low terraces	Sandstone and limestone.	Undulating	Medium	Rapid	Grayish-brown friable fine sandy loam to loamy fine sand.	10	Yellowish-brown to reddish-brown firm fine sandy loam to sandy clay loam.	24	Moderately productive. Very easily worked. Suited to wide variety of crops and especially preferred for certain truck crops. Some acreage is subject to occasional overflow.
BOTTOM LANDS										
		Alluvium comprised chiefly of material from—								
Huntington	Higher parts of first bottoms along Tennessee River.	Limestone	Nearly level	Slow	Medium	Young soil. Slightly alkaline to medium acid. Predominantly rich brown to a depth of about 30 inches. Upper part fine sandy loam to silt loam; lower part variable.				Fertile and productive. Especially well suited to corn. Subject to overflow.
Lindside	Lower parts of first bottoms.	do	do	do	Slow	Young soil. Intermediate in drainage between Huntington and Melvin. Slightly alkaline to medium acid. Brown silt loam to a depth of 10 inches. Mottled below.				Fertile and productive. Well suited to hay and corn, but corn is injured occasionally by too much moisture. Subject to overflow more frequently than is Huntington.
Egam	Higher parts of first bottoms.	do	do	do	do	Young soil. Surface 15 inches of grayish-brown friable silty clay loam is underlain by dark brown or nearly black compact silty clay. Mottled below 30 inches.				Fertile, but productivity is restrained by the compact subsoil. Better suited to hay, corn, and pasture.
Roane	Small intermittent creek bottoms.	Cherty dolomitic limestone.	do	do	Medium to slow.	Young soil. Acid. Characterized by a tightly embedded chert layer about 6 inches thick at a depth of about 20 inches. Surface material is grayish-brown silt loam, friable. Variable amount of chert throughout.				Moderately productive. Broader areas commonly cropped to corn and hay crops. Some areas very cherty and badly dissected by drainage channel. Occasionally overflowed.
Melvin	Lowest parts of first bottoms.	Limestone	do	Very slow	Very slow	Young soil. Slightly alkaline to medium acid. Brownish-gray friable silt loam surface layer underlain at 12 inches by highly mottled silty clay.				Poorly suited to tillage because of undesirable moisture relations. Fair to good pasture.
Dunning	Lower parts of first bottoms.	Limestone (chiefly Colbert and Talbott soils).	do	do	do	Young soil. Slightly alkaline to neutral. Very dark gray to nearly black silty clay surface layer. Mottled gray and yellow clay below about 22 inches.				Fertile, but drainage, overflow hazard, and consistence limit its suitability for crops that require tillage. Fair to good pasture.
Staser	Natural levee at bank of Tennessee River.	Limestone, sandstone, and shale.	Gently undulating	Medium	Very rapid	Young soil. Weakly acid to neutral. Brown loamy fine sand underlain generally at a depth of about 6 inches by darker loamy fine sand. Lighter colored sandy material below a depth of about 48 inches.				Lies in narrow sandy strips at the riverbanks. Much of it is inclined to be droughty. Easily worked, but of low fertility.
Pope	First bottoms along creeks.	Sandstone and shale	Nearly level	Slow	Medium	Young soil. Medium acid. Brown to dark brown, friable. Texture ranges from loamy fine sand to silt loam. Mottled below a depth of 30 to 50 inches.				Moderately productive, subject to overflow. Used chiefly for corn and certain hay crops.
Philo	Lower parts of first bottoms along creeks.	do	do	do	Slow	Young soil. Medium acid. Grayish brown to dark brown, friable. Texture ranges from fine sandy loam to silt loam. Mottled below a depth of about 20 inches.				Of moderate fertility. Imperfect drainage and susceptibility to overflow limit its productivity and suitability for crops. Corn, hay, and pasture are the chief crops.
Atkins	do	do	Nearly level (depressional).	Very slow	Very slow	Young soil. Medium acid. Gray friable loam or silt loam, underlain at about 6 inches by mottled material.				Of moderate to low fertility. Poor drainage and susceptibility to overflow limit its suitability to pasture and meadow.

[1] Texture and thickness where not affected appreciably by erosion.
[2] Applies particularly to that part of the soil profile directly below the surface soil, generally characterized by uniform color and slightly finer texture than the material above.
[3] High-grade limestone refers to limestone with a relatively low content of insoluble siliceous impurities.

545846—48 (Face p. 28)

SOIL MAP
RHEA COUNTY—SOUTHERN SHEET
TENNESSEE

TENNESSEE AGRICULTURAL EXPERIMENT STATION
C. A. MOOERS, DIRECTOR
TENNESSEE VALLEY AUTHORITY



Polyconic projection, 1927 North American datum.
Base map in part from T. V. A. Planimetric Maps.
10000 foot grid based upon Tennessee system of plane coordinates.
Surveyed in 1938-40. Series 1940.